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Fundamental Action of Lubricants

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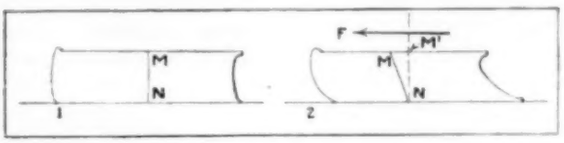
While thick-film lubrication depends upon no other property of the lubricant than viscosity, thin-film lubrication depends also on the factor of oiliness

As THE primary object of using a lubricant is to keep the bearing surfaces apart, the thickness of the film is a matter of considerable interest. If the operating conditions and the nature of the bearing surfaces are such as to permit the formation of a sufficiently thick film we have the simplest and most desirable type of lubrication. This may be termed thick-film lubrication. On the other hand when the film thickness falls below certain limits the action of the lubricant becomes more complex and must be dealt with under the head of thin-film lubrication.

In order to maintain a thick film of any fluid lubricant it is necessary, in general, for the bearing surfaces to be inclined to one another at a slight angle (Ref. 1). [References to publications will be found at the end of this article.] This permits the formation of a wedge of the lubricant, which tends to separate the bearing surfaces and thus serves to support the load. If the surfaces are parallel or inclined the wrong way, this wedging action is lost and the main body of the lubricant escapes.



Figs. 1 and 2—Action of shearing the pages of a book to illustrate the definition of absolute viscosity

The load carrying action of a wedge-shaped oil film is similar to that of the air directly under the wing of an airplane in flight. In each case a fluid pressure is developed on the under side of the inclined surface purely as a consequence of the relative motion. On the upper surface of the airplane wing, and on certain portions of the lubricated bearing surface, negative pressures are also developed, and it is simply the resultant of all these positive and negative fluid pressures that supports the load. This will be illustrated below in connection with journal bearings.

Besides having the proper inclination of bearing surfaces, a second prerequisite to insure the maintenance of a thick film is obviously that of having an adequate supply of lubricant in immediate contact with the moving surface. This is a practical matter which will be fully discussed by other contributors later in the series of articles.

The principal operating factors that can influence the maintenance of a thick film are speed, load, and temperature of the lubricant. Since, however, the temperature comes into the problem only indirectly through its effect on thermal expansion of the metals and on the viscosity of the oil, we may state that for bearings of any particular size and shape, the only factors to consider are the speed, the load, and the absolute viscosity of the oil at the true temperature of the film.

Film thickness at the point of closest approach increases with increasing speed, with increasing viscosity, and with decreasing load. It has, in fact, been proved that film thickness depends on the product of speed by viscosity divided by load, from which it follows that the same thickness will be obtained at one-half the speed provided the load is also reduced to one-half or provided the viscosity is doubled, etc. (Ref. 2).

The only property of a fluid lubricant that can appreciably influence its mechanical action in thick-film lubrication is its viscosity. We refer to its viscosity at the true temperature of the film, not at the room temperature or at some arbitrary standard temperature. The chemical composition of such a lubricant has no influence on the result except indirectly through changes that may occur in its viscosity as a result of changes in chemical composition.

The nature of the bearing metal can have no direct influence in thick-film lubrication provided the oil actually wets the metal. If two bearings are of exactly the same size and shape under the same operating conditions, they will have the same friction loss and load capacity regardless of the composition of the bearing metals.

A large proportion of modern, high-speed, rotating machinery normally operates under thick-film lubrication conditions. These conditions should always be aimed for in bearing design, but since they cannot always be realized the study of thin-film lubrication has become

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equally important, and an attempt will be made to summarize briefly the information acquired to date on this subject.

Thin-Film Lubrication

Any machine at the moment of starting, stopping or reversing its direction passes through zero speed and thereby fails to meet one of the requirements for the maintenance of a thick film. Bearing surfaces that are too heavily loaded on small areas cannot support a thick film; gear teeth and cutting tools, for example. Parallel surfaces like the ways of a planer and the rubbing surfaces of a piston and cylinder, in general cannot be expected to maintain a thick film, although they may do so momentarily.

Thick-film lubrication depends on no other property of the lubricant except its viscosity; thin-film lubrication depends, in addition, on some unknown factor or group of factors collectively known as the property of *oiliness* (Ref. 3). The foregoing statement may be taken as a definition of thin-film lubrication.

It will naturally be asked just how thin a film must become before it ceases to be governed by the ordinary laws of viscosity and begins to exhibit different properties from those which the same lubricant possessed when examined in bulk. From experiments with an accurately constructed tapered plug rotating about a vertical axis in a bearing which could be raised and lowered by means of a slow-motion screw, using various lubricating oils, Kingsbury (Ref. 4) was unable to find any departure from the ordinary laws of thick-film lubrication down to films at least as thin as 1/40,000 (0.000025) of an inch. The exact limit is probably not sharply defined; it depends on many different factors that are not yet understood, and would undoubtedly be greater than the foregoing for roughly finished surfaces and less for absolutely smooth surfaces, because of the tearing effect of projections on rough surfaces.

Viscosity Defined

The practical evidence of thin-film lubrication consists in a very marked increase of the co-efficient of friction when the speed is sufficiently diminished or the load sufficiently increased, together with the fact that two oils of the same viscosity under identical operating conditions may give different co-efficients of friction, and the fact that the same oil will give different co-efficients under identical operating conditions when different bearing metals are used in conjunction with different journals.

The absolute viscosity of any liquid is a measure of its resistance to internal deformation, and is defined as the ratio of shearing stress to rate of shear. Imagine a cube of liquid having a height or thickness h, the bottom of this cube being held stationary while the top surface is pushed along with a velocity v. If the area of the top surface is A and a total force F is applied to it in the direction of motion the shearing stress on that surface will be F/A which may be denoted by S. The rate of shear is v/h which may be denoted by R and expressed in radians per second.

By definition, then, the absolute viscosity is the value of the ratio S/R, and this ratio is a characteristic which varies with different liquids, although it is a constant for any one liquid at a given pressure and temperature. Plastic substances, such as grease, or oils containing soap, will be excluded from consideration in this article, as the value of S/R is not a constant for such substances but diminishes with increasing rates of shear.

Demonstrating Viscosity by Analogy

To illustrate this idea of the rate of shear, or rate of internal deformation, on which the measurement of viscosity is based, consider the edge view of a thick book, Figs. 1 and 2. Draw a vertical line across the edge of the book with a lead pencil as shown by MN, Fig. 1. Push on the top of the book with one hand exerting a force F toward the left, as at Fig. 2. This action rotates the pencil mark MN through some small angle MNM' which can be taken as a measure of the shearing deformation produced by the force F applied.

The rate of shear, R, in radians per second is the quotient of the angle MNM' in radians divided by the time elapsed in seconds. It follows from elementary geometry that when the time interval is taken short enough so that the angle in radians is numerically equal to its tangent, the foregoing definition of R is equivalent to the ratio of velocity v divided by film thickness h in the case of the liquid cube.

In a simple viscous liquid such as ordinary lubricating oil, the application of a constant force F or shearing stress S (force divided by area) serves to maintain a constant and continuous rate of shear R, after a steady state has been attained so that there is no acceleration. Any variation of shearing stress produces a proportional change in the rate of shear, and so the shearing stress is equal to a constant times the rate of shear.

It is very much harder to shear some liquids than others at any given rate; thus the foregoing constant is a characteristic of different substances and has been named viscosity. Denoting viscosity by the letter Z (from the German *Zähigkeit*) we have by definition

$$Z = \frac{S}{R} \qquad (1)$$

Substituting in equation (1) the expressions previously given for R and S, we obtain for the magnitude of the force F necessary to maintain a relative velocity v between the upper and lower surfaces of a film of lubricant of thickness h and area A,

$$F = Z\left(\frac{A}{h}\right)v \qquad (2)$$

The force F is therefore a measure of the frictional resistance of any liquid film of uniform thickness h. Equation (2) has a very simple and important application to journal bearings which will be discussed later.

Absolute viscosity is measured ordinarily by observing the rate of flow through a long, fine capil-

Table I—Relation Between Absolute and Saybolt Viscosities

S. U. V. Seconds	Absolute Viscosity — Sp. Gr. 0.80 — Poises	Absolute Viscosity — Sp. Gr. 0.80 — Lb.-Sec. per Sq.In.	Absolute Viscosity — Sp. Gr. 0.90 — Poises	Absolute Viscosity — Sp. Gr. 0.90 — Lb.-Sec. per Sq.In.
32	0.009	0.00000013	0.010	0.00000015
40	0.033	0049	0.038	0054
50	0.059	0086	0.067	0097
100	0.165	0240	0.195	0283
150	0.213	0309	0.238	0346
200	0.349	0507	0.393	0571
250	0.438	0626	0.492	0714
300	0.526	0763	0.592	0860
400	0.704	1020	0.792	1150
500	0.880	1280	0.990	1440
600	1.055	0.00001530	1.187	0.00001720

Table II—Effect of Temperature on Viscosity

Temperature, t		Ratio Z/Z₀ for Typical Oils		
Deg. C.	Deg. F.	Naphthene Base	Paraffin Base	Fatty Oil
0	32	11.6	8.8*	4.3
20	68	1.43	1.36	1.30
25	77	1.00	1.00	1.00
30	86	0.74	0.76	0.87
50	122	0.28	0.31	0.42
100	212	0.060	0.100	0.120
150	302	0.025	0.035	0.056
200	392	0.011	0.018	0.029

Z = absolute viscosity at *t* degrees C.;
Z₀ = absolute viscosity at 25 deg. C.
*Generally below pour point unless dewaxed.

lary tube. It can also be computed with sufficient accuracy for most purposes from the more familiar Saybolt Universal Viscometer (S.U.V.) readings, provided the specific gravity is known.

Table I (based on Ref. 5) gives absolute viscosities in both metric and English units for two different specific gravities, corresponding to Saybolt readings from 32 to 600 sec. At 100 deg. F. the viscosity of kerosene is about 32 Saybolt sec.; that of lard oil or a light machine oil, about 200 seconds.

Laboratory data on absolute viscosity are usually given in poises, both in England and the United States as well as on the Continent. The poise is the C.G.S. (centimeter-gram-second) unit, named after Poiseuille. In equation (2), if A is measured in square centimeters, h in centimeters and v in centimeters per second, F will be in dynes, provided Z is in poises, i.e., dyne-seconds per square centimeter.

The term *reyn* has been tentatively proposed by H.A.S. Howarth, of Philadelphia, for the English unit of viscosity in the inch-pound-second system, in honor of Reynolds. In equation (2) if A is measured in square inches, h in inches, and v in inches per second, F will come out in pounds, provided Z is expressed in reyns, i.e., pound-seconds per square inch. One reyn = 68,900 poises (more exactly, 68,947).

Temperature and Pressure Effects

The remarkable loss in viscosity experienced by lubricating oils with increasing temperature is illustrated by Table II, which shows the effect upon three general classes of oils.

Acknowledgment is made to Winslow H. Herschel, associate physicist, Bureau of Standards, for the data used in compiling both Tables I and II. Table II contains data applicable to practically all petroleum and fatty oils that are not too far removed from a Saybolt viscosity of 200 sec. at 100 deg. F. It will be seen that the temperature effect is much less pronounced for the fatty oils, which include both animal and vegetable oils. Castor oil, however, is an exception to the usual rule, having about the same temperature effect as a paraffin-base petroleum oil of equal viscosity. The fatty oil ratios were computed from lard oil data.

Table II applies to viscosities at atmospheric pressure. When the pressure is increased at a constant temperature, all lubricating oils gain in viscosity. Under high pressures such as are met in gear tooth and cutting tool lubrication, the loss in viscosity due to rise of temperature is even greater than shown by the table, especially for the petroleum oils (Ref. 6). This fact may help to explain the recognized superiority of fatty oil for thin-film lubrication.

When certain critical pressures of the order of 20,000 lb. per sq.in. are reached, some oils undergo a change which has been described as apparent solidification (Ref. 6). This probably aids in preserving the oil film and in automatically preventing metallic contact between the high spots on the two bearing surfaces which are in relative motion.

From the foregoing it will be evident that the effect of pressure on viscosity may constitute one of the factors entering into the elusive property called oiliness.

Definition of Oiliness

Oiliness has been defined by Herschel as the property which causes a difference in the friction when two oils having the same viscosity at atmospheric pressure and at the true temperature of the oil film are used under identical conditions (Ref. 7). The oil giving less friction is then considered as possessing greater oiliness. It does not necessarily follow that the oil having the greater oiliness will give less wear; in fact there is some evidence to the contrary.

(To be concluded)

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Wanted—Mechanics

By H. M. Darling

Engineer, Wells Tap & Die Company

THE present feverish activity in the machine-tool business, "shows up" the short-sighted policy of many manufacturers who make no effort to train apprentices. Some people tell me that they would rather hire skilled help than bother to train apprentices. Of course they would, but if we all adopt this policy, where will we get skilled help when the present crop of mechanics die or retire?

I get a lot of satisfaction out of teaching young men, if they have the right "stuff" in them, and in watching their later progress. Yesterday, I met a lady whose boy worked for me several years ago. I asked, "Where is Billy, and how is he getting along?"

"Why, he is up in New Hampshire," she replied, "toolmaking, and getting along fine."

Now, I get a real "kick" out of such a thing as that, when I think that I am partly responsible for that boy's progress. Teaching apprentices may be a lot of trouble, but it is some satisfaction, too, when these boys grow up as a credit to your training, and incidentally, it is helping the whole machine-building industry.

Spending Production Savings on Sales

"IT'S THE bank balance that tells the real story," said George Greely, president of the Tractor Company, as Bill Holland, consulting engineer, came into the office.

"That sounds like an epigram, George," said he. "What's it all about?"

"We're trying to find out why we didn't make more money last year, Bill. We sold more tractors, but there seems to be some sort of a leak in the profit barrel. The net is a bit disappointing."

"Been cutting prices, John?" asked Bill of John Watkins, the sales manager.

"You bet we haven't, Mr. Holland. The 'old man' wouldn't let us if we wanted to, and we don't want to. The trouble seems to be with the shop end, though Jack Miller here swears it isn't the case."

"I'll say it isn't," said Jack emphatically. "You birds up in the sales end think a twenty-five per cent increase in output ought to cut production costs in half."

"Well, doesn't it make for lower costs when I work up the sales twenty-five per cent above last year? And believe me, Mr. Holland, it wasn't easy."

"And didn't I reduce costs, too, Watkins? The cost records show a nice saving over last year. And that wasn't easy, as the costs were pretty low before," retorted Miller.

"It may seem a lot to you, Jack. It was about twenty-five dollars a tractor, as I remember it. But twenty-five dollars doesn't mean much when it comes to a tractor sale."

"Maybe not, Watkins, but it means a lot over twenty per cent in the labor cost of the whole machine. I don't specify materials, all I can save is in direct labor. And I'll bet you a five spot you didn't save as much as that in your department."

"Don't get personal," chimed in the president. "We're not trying to discredit anyone, but we do want to find out just where the trouble lies. Any suggestions, Mr. Holland?"

"It seems to me, George, that Jack asked Walter a question he hasn't answered. When it comes to reducing costs, all departments have to take a hand. How about it, Walter—did you reduce the cost of selling as much as Jack saved on his end of the game?"

"I don't know as I did, Mr. Holland. We've had competition, and it wasn't easy to sell the increased output."

"May have even cost you more, I guess. That seems to put it up to Jack to make all the saving, and his costs seem to be pretty near down to hard-pan.—George," said Holland, turning to Greely, "did it ever occur to you that a bigger output doesn't necessarily mean more profits?"

"No, Bill, it hadn't. When Walter here wanted to boost the output it looked good to me. But just what are you driving at?"

"I've bumped into several cases, George, where increased output meant decreased profit. We seem to think only of the production saving due ro making work in bigger lots. Sometimes this saving isn't as large as we anticipated. The net, however, depends largely on the market. With an unlimited market, the more you turn out the greater your profit. But that doesn't seem to be your case. Walter says it's been hard to sell the extra product.

"Seems to me it's just a question of mathematics, when you know all the factors. It takes only a little increase in the cost of selling the extra volume to wipe out any saving you get from the increased production.

"Your remark about the bank balance telling the story, just as I came in, hits the nail on the head. It's quite likely that Jack can maintain part of his savings even on last year's output. Perhaps you can gage the output by the cost of sales. It may be worth thinking about, George."

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

EXECUTIVE FORUM

Discussion

Rewards for Suggestions

A good plan to follow in operating a suggestion system is to divide the suggestions into two classes. In the first class are those dealing directly with production and manufacturing improvements. The second class relates to changes in general administration. For suggestions in the first class, payment should be made in the form of periodic bonuses over a specified length of time. A flat sum of money is the best type of reward for suggestions of the second class.

—SAMUEL KAUFFMAN.

One suggestion system, with which I am familiar, has been unusually successful. It operates in the following manner. When an employee has a suggestion to submit, he discusses his idea with the foreman, or his immediate supervisor. If this man agrees that it is a worthwhile suggestion, the workman will forward it to the suggestion committee for consideration. This plan heads off the turning in of many suggestions which are of no value, and thus saves the time of the committee which goes over the ideas to decide on their merits.

If a suggestion is accepted which saves time in the manufacture of a part, or introduces an improvement with the shop, the employee is awarded a cash prize of from $5 to $25, depending on the merit of his idea. If the suggestion concerns an improvement in the design of a part manufactured by the company that will increase sales, or if it relates to a new device upon which the company can obtain patents and manufacture and market the product, an agreement is entered into with the employee whereby he is rewarded for his suggestion on a royalty basis.

—MORTON SCHWAM.

Handicapping Salesmen With Wrong Information

The problem of co-ordinating engineering and sales information is of considerable significance, and, due to the very difference in nature of the two types of mind, it is essential that it be controlled by some well established procedure. The interpretation of a clerical mind is the only practical solution.

Through this clerk should pass all new or revised drawings for recording before they are issued to the shop for manufacturing. This record should show the serial number of the machine on which any significant change is first effective. From this source should eminate all blueprint distribution. An official file, bound if practical, may be furnished sales and other departments for information only—but no extra copies for distribution. Keeping the official file up-to-date is the clerk's duty, which should include responsibility for destroying obsolete prints. All requests from the field for prints should go to this clerk for handling.

—DONALD R. WATSON.

Can Shop Losses be Charged to Sales?

Every part sent through the shops of a company should, in general, pay its own factory costs and make some profit for the company. But the manufacturing of occasional small repair parts is a costly affair, and if an attempt is made to sell them at a direct profit, the selling price is almost prohibitive. It is customary to take a small loss on the sale of such articles because of the advertising value of the deal, and the good will that it creates. The sales department is rightly charged with the cost of all advertising and promotion work. Hence the loss incurred in making and selling special repair parts for a low price should be charged to this department. Such service is good advertising, produces good will and stimulates the sale of items which return a profit. —L. O. BROWN, *Toolroom Foreman, Holcomb and Hoke Manufacturing Company.*

Getting Men from Other Industries

The company by which I am now employed, one of the leaders in the electrical field, is proud of the fact that it finds executives, from the gang bosses to plant manager, within its own organization. To make such a plan possible, an extensive educational system has been built up for employees. Classes are held both during and after working hours. This opportunity for study, coupled with the first-hand information always obtainable from a large, fully-equipped laboratory and experimental shop, makes it easy for workers who want to know more about the business to gain this knowledge.

In a small shop, however, such a system does not usually exist. In the absence of a staff of experts, it is the duty of the superintendent and his immediate subordinates to work out new economies and labor-saving methods, whereby the product being manufactured can be produced and sold at a price to meet the competition of the market and pay a dividend to stockholders. Where the superintendent has developed capable assistants who have the necessary executive ability, and who have been trained to think along economic and progressive lines, his successor can be picked

from among this group when he leaves. A man obtained by this method can usually carry on operations with a success equal to, or perhaps even greater than, that of his predecessor.

But an executive of the right calibre would not necessarily have to come from the same line of business, providing he had the necessary general manufacturing knowledge. His chief qualifications should be the ability to lead men, the versatility to adapt himself to the immediate surroundings, and a willingness to use the equipment at his disposal to the best advantage, pending the opportunity to replace it with equipment of a more modern type. Where one man could come in and build a concern up gradually into a paying business, another could just as easily fail, and might ruin the business more quickly than the previous superintendent, if he has been inefficient.

—C. L. ANDERSON, *Methods Engineer, Western Electric Company, Inc., Emeryville.*

Getting Details on Overhead Costs

If every machine is given a number there is no great difficulty in charging all maintenance time and material against individual machines. It is a good plan to submit such details to the departmental foremen, and put it up to each one or them to make suggestions for the reduction of some of the costly items. They will soon begin to take an interest in the more expensive machines, and ask for advice on such problems as they cannot master but which seem to them to be solvable.

Every large plant should have its own transmission man, if possible an expert, who has some direct incentive to keep down transmission costs. If a belt is overloaded, it is almost certain that bearings will be overloaded, and possibly also shafting and pulleys. Recording dynamometers of various kinds should be available for checking the actual load. An ammeter should be fitted to every motor starter. When the exact conditions of loading are known it is a fairly simple matter to choose the correct belt, rope, or chain. Shocks cause as much trouble as anything, and must be overcome if at all possible, not by the provision of extra powerful drives but by heavy-rimmed pulleys, shock absorbers or balanceweights.

—H. JAMES, *England.*

Rules—and When to Break Them

Rules are established by the factory manager to maintain discipline in the shop and to regulate procedure in an orderly manner. They should apply to everyone alike, from the manager himself down to the last apprentice. In fact, the man who made the rules must be the first to observe and enforce them. He is responsible for their wise application.

However, occasions arise when it is impossible to follow established rules. In such cases, the violation of the rules should be clearly and openly characterized as an exception and not as a precedent. If the rule has outlived its usefulness, of course, it should be promptly modified or cancelled.

—FAUSTO BECERRIL, *Military Engineer, Chapultepec, Mexico.*

In the designing department of one of the English factories, a general instruction forbids the use of a certain grade of material unless specially sanctioned by the chief of the department. In other words, the general rule is enforced, but at the same time the desired flexibility is attained by the provision for reference to a higher authority. That principle, it would seem, could be given wider application, so as to cover just such cases as the one which forms the basis for the present discussion. The rule, though avoided, is not broken.

Where a rule embodies the honorable fulfillment of a managerial promise, however, it has to be observed in all strictness by the management. Otherwise, the integrity of the executives is open to suspicion, and shop morale is broken down. —W. R. NEEDHAM, *England.*

Is the Shop the "Goat"?

In the case of the Arrow Manufacturing Company, where the discussion came up regarding the chance for further cost-cutting in the shop, it looks as though the sales manager, Jim Henry, was having trouble in getting a satisfactory volume of business, and had used the higher price charged for the company's product as an alibi. In the first place, a conference between the sales and production heads usually accomplishes little under such circumstances. Their lines are so different that it is almost impossible for either to be well posted on the problems of the other.

If the sales manager finds the competitor's price too hard to meet, the situation should be made clear to the general manager. It is then the place of the general manager to see what can be done about a cost reduction. The sales manager is certainly out of his place when he arbitrarily demands a cost reduction in the shop. The general manager, alone, can co-ordinate the activities of all departments.

If the sales manager wanted to go to the production manager over the head of the president of the company, in regard to costs, he should have used tact. Controversies at conferences, where each man takes it upon himself to criticize the accomplishments of other departments, look bad for the entire organization. Each man should be willing to attempt to cut costs in his own department, and co-operate with other departments in this effort. Only by such teamwork and harmony can the business succeed.—GEORGE WILSON.

Welded Tooling Practice in a West Coast Plant

Advantages of built-up jigs and fixtures, and several production tools made by welded construction

GENERALLY speaking, the built-up form of welded tool has a wider field of application than is ordinarily supposed. Many types of jigs and fixtures can be assembled by joining together steel sections to correspond with the features wanted, thus assuring a practical, dependable tool. Limiting factors exist, however, such as complicated designs where the torch or arc cannot be applied with ease, and fixtures of unusual size and shape that would not be satisfactory from a practical standpoint. Tools of this class are not frequently encountered, leaving the scope of welded construction rather broad in this particular field.

Several designs of jigs and fixtures made by the so-called built-up process are described. They are in use at the Hall-Scott Motor Car Company, where welding is considered as a necessity in modern tool design. Even a step further has been worked out, that is the construction of built-up die sets, some of which are illustrated, although this construction is limited at present to special forms of dies.

Welded tooling at this plant has been found to offer the following advantages: No patterns or castings are required; the elapsed time to construct a complete jig or fixture is far less than required when castings are needed; a stronger construction is made possible; the weight is less as compared to other forms; less machining is required to complete an assembled tool; a reduction of cost is made possible; and miscellaneous small pieces of steel often considered as scrap can be utilized. Considering the cost alone, jigs and fixtures are built at an average saving of 10 per cent according to figures kept over a period of several months. This consideration, however, is not the controlling factor, as the speed of getting the tool in use is the main demand, especially in high-production shops. A saving of two or three days time is not to be overlooked.

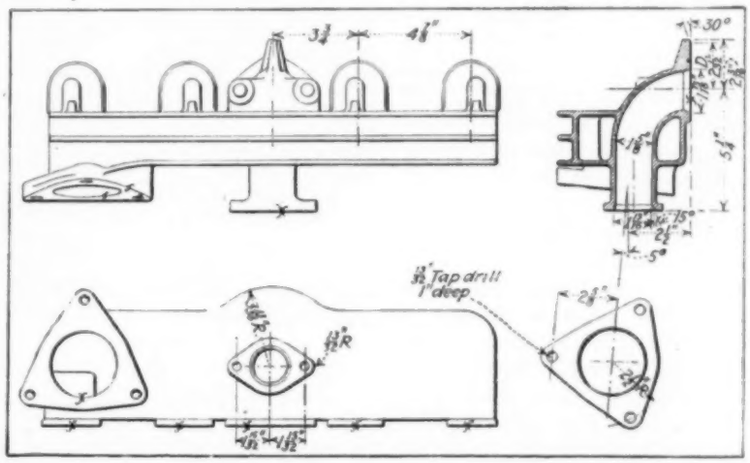


Fig. 1—Design layout of an exhaust and intake manifold made with built-up welded jigs and fixtures. The operations performed include milling, drilling and counterboring

Practically all of the tooling for exhaust manifolds shown in Fig. 1, is made of welded construction. Recent design changes in the manifold made obsolete most of the former jigs and fixtures, and it was decided to design the new tools embodying

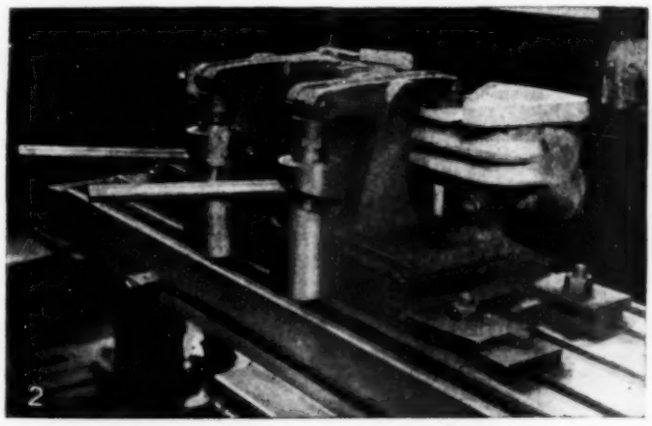


Fig. 2—Welded fixtures can be constructed in less time than is required for tools with cast-iron bases. This tool shows a representative built-up milling fixture having two overhead swinging clamps, cam operated, and several adjustable locating points. Fig. 3—A duplex-type milling fixture made of welded construction. The operations are the milling of the clamping faces, which is done at the right and the machining of an angular face at the side at the left. The design shows the practicability of built-up tooling

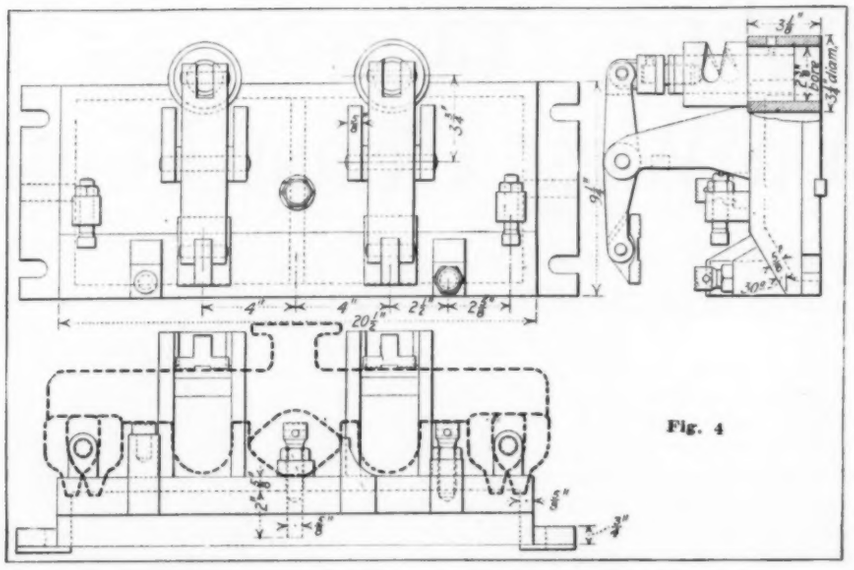
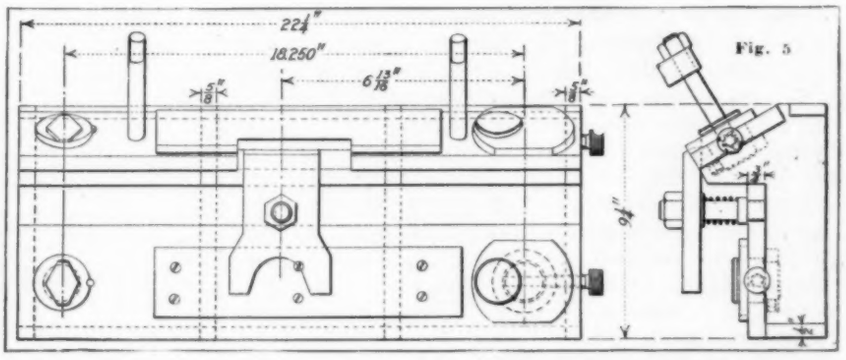


Fig. 4 — Layout of the fixture for milling the port- and carburetor-connection faces of manifolds. Joints requiring welding are indicated by solid fillets to the assembler. Fig. 5 —the base of this fixture is made of machine-steel plates, ½, ⅝, and ¾ in. in thickness. Two pieces are held at each setting, so that both operations can be completed at the same time. Two styles of manifolds are accommodated by varying the position of the locating studs at the right of the fixture

built-up specifications. A welded milling fixture employed to machine the ports and carburetor connection of manifolds is illustrated in Fig. 2. The same fixture is shown in Fig. 4, where the constructional features are outlined. The base is made of ⅝-in. steel plates, joined together in such a way that the unit resembles a cored casting, and makes a substantial, strong design. The four upright members, supporting the two swinging-type clamps, are also made of ⅝-in. plates cut to shape by a torch flame. At the operating side of the fixture, two 3½-in. diameter bushings are welded in place to receive the quick-lift cam assemblies. Bosses for the locating pins and for the adjusting screws are welded at the top of the base, there being five in all. A ¾-in. plate is welded at each end of the base for the U-lugs, thus completing the basic construction of the fixture illustrated at the top.



Prior to the machining of fixtures built in this manner, they are heat-treated, or normalized, at 1,500 deg. F., so that all strains set up during welding will be removed. Hard spots are also eliminated, which insures proper machining quality. Other advantages are: The built-up fixture will not warp after machining, and its weight being less, it is handled more easily.

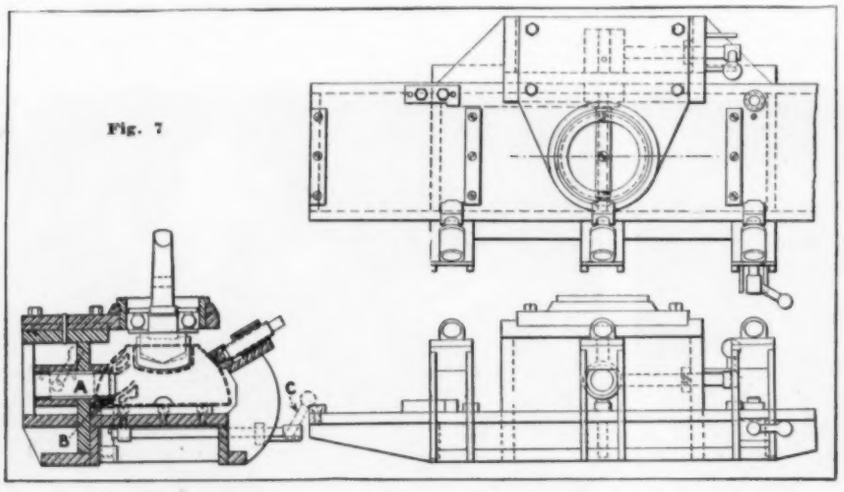
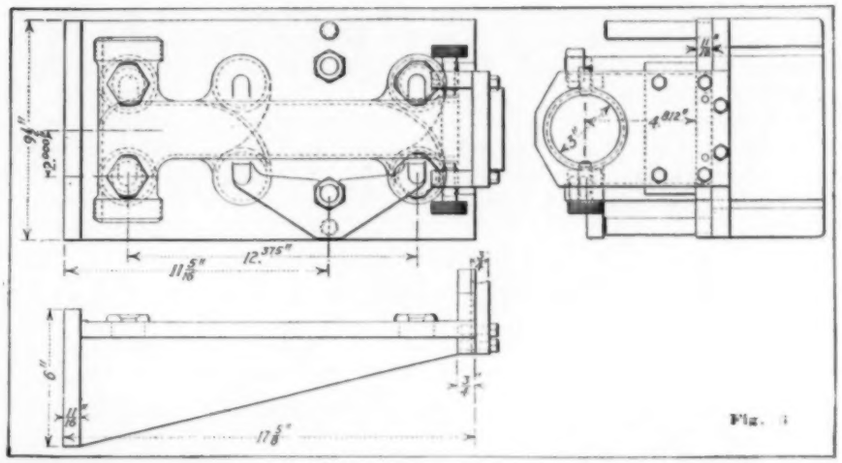


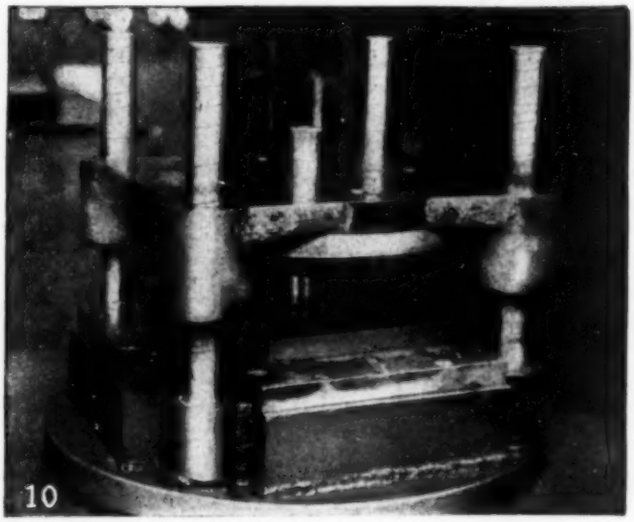
Fig. 7—A welded fixture for counterboring cylinder heads showing the possibility of extending the use of built-up tooling to larger designs of a more complicated nature. Several features are incorporated in the design, including three spring-type locating clamps, a guide bushing for the ball-bearing counterbore support, and two eccentric-type locating plunges, one operated at the rear and the other at the front

Machining a fixture of this kind is comparatively simple. The bottom surface of the base is machined first, to provide a proper locating face, then the remaining operations are the milling of the bosses, drilling and tapping the various screw holes, boring of the two large holes, and milling the U-lugs.

Another welded milling fixture for the manifold is illustrated in Fig. 3. The operation performed is the finishing of the clamping faces and the 30-deg. angular face at the port side. Constructional features of the fixture are illustrated in Fig. 5. The size of the plates used for the base vary from ½ to ¾ in. in thickness. The ends are ⅝ in., and the sides are ½ in., while two strengthening ribs at the center are made of steel ⅝ in. thick. Provision is made for holding the work at two different planes, enabling two pieces to be machined. Counterboring the 2.375-in. hole at the

Fig. 6—A counterboring fixture for manifolds arranged to accommodate either left- or right-hand units. The base of the fixture is made of a 9x9½-in. plate, a 9½x17⅝-in. upright member, two ⅜-in. ribs and a ¾-in. top plate in two pieces, all of which are welded together. The bushing support plate is attached by screws and dowels. Fig. 10—A drawing die made of a built-up die set arranged with four leader pins. In constructing a tool of this type, the procedure is to finish the necessary welding, then anneal the assembly at 1,500 deg. F. before machining



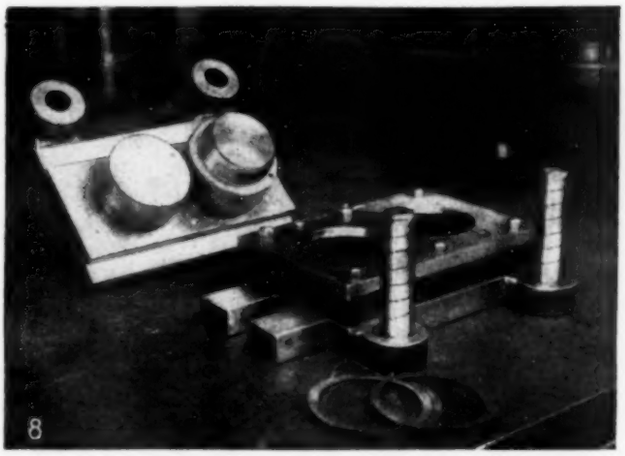


end of the exhaust manifold is done in the built-up jig illustrated in Fig. 6. Its construction follows closely the principles carried out in building the tools described previously, although in this case the work is held in an upright position and the $\frac{11}{16}$-in. thick by 9½-in. wide upright member is supported by two ⅜-in. ribs in order to give sufficient rigidity. The jig is arranged to accommodate left- and right-hand manifolds merely by shifting the clamp from one side to the other and fastening it in position.

A further application of welded construction is shown in the fixture illustrated in Fig. 7, which is used for counterboring the combustion chambers of the cylinder heads. The work rests on hardened plates, and is located by the insertion of the plug *A* into previously bored port holes at the left side, and the plug *B*, operated by the handle *C*. Positioning from one location to the next is done by withdrawing the plug and sliding the cylinder head to the next setting, and again engaging the location plug. Clamping is by any two of the three angular clamps to suit the relative position of the work. The design offers a contrast to the other fixtures described, and shows some practical features applicable to the design of tooling for larger parts.

A progressive die for piercing and blanking camshaft driveshaft shims, made of 0.005-in. brass, is illustrated in Fig. 8. The die shoe is made of a 1¼-in. steel plate, to which two guide pin supports are attached by welding. The die plate and the stripper are assembled by screws and dowels. The punch holder is made in a similar manner, although the bushings are somewhat longer and are bored to receive the guide pin. Some of the shims made in the die are shown at the front.

Another two-pin die of welded construction is illustrated in Fig. 9. It is for notching and forming baffle plates for the cylinder heads. The die shoe in this case



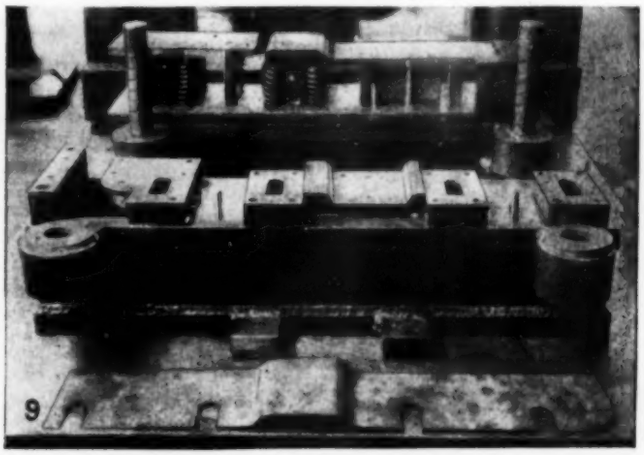


Fig. 8—Welded construction is being applied to dies such as this progressive die for a brass shim, 0.005 in. in thickness. Both the die shoe and punch holder incorporate the built-up principles. Fig. 9—An example of a notching and forming die of the two-pin type, somewhat longer in shape than the usual run of press tools. A welded box construction is used and the cutting and forming sections are attached by screws and dowels

is built up of a box construction, somewhat on the order used in making fixture bases. The side walls and the ends are made of $\frac{5}{8}$-in. plates, and the top face is made of a 1-in. plate.

A four-pin die set made with a box-type die shoe is illustrated in Fig. 10. The punch holder in this case is made of a steel plate, $1\frac{1}{4}$ in. thickness, to which four cast-iron bushings are attached by brazing. The bushings in the die shoe, however, are made of steel and are welded in place.

All welding is done by the electric arc using standard equipment. The tools required for welding fixture assemblies consist of several C-clamps, parallel clamps, scales, combination squares, and different sized angle plates. An experienced welder soon acquires the technique needed to construct built-up tooling.

Does Standardization Prevent Change?—*Discussion*

By John F. Hardecker

Chief Draftsman, Naval Aircraft Factory

I HAVE read with considerable interest your editorial on page 410, Vol. 70, of the *American Machinist*, under the above heading. Not only do I agree heartily with your observations, but I seriously question whether the lecturer quoted really understood what standardization meant. Perhaps the best definition I have ever heard is, "Standardization is common sense applied to creative individualism for the purpose of achieving the greatest good for all."

While standardization is probably at present more advanced in the automobile field than in any other branch of manufacturing, the aircraft industry presents some interesting phases of the problem. With the successful activity of the automobile industry as a guide, standardization was probably undertaken at an earlier stage of the aeronautical industry's development than has been the case in any industry. So, fostered by the Army and Navy and the Society of Automotive Engineers, standardization has made rapid strides in aircraft activity. One could hardly claim that development has been handicapped thereby, for today there is a wide diversity of plane design, and more individual manufacturers of airplanes than there are of automobiles. Yet, standardization has been a big factor in an industry in which not a single manufacturer is in "production," if by production we mean the volume output attained by complete tooling up in other industries.

In fact, I would go so far as to say that standardization has fostered development and change in the aircraft industry. If each manufacturer made his small screw-threaded parts so that they were not interchangeable with those of other manufacturers, an improvement or new design would probably apply only to one man's product, and the resultant good of the change would not be available to the entire industry. If parts were not standardized, the specialty manufacturer would not have any incentive to improve his products by bringing to them the specialized knowledge of his engineering force, for the resultant volume to which his improvement was applicable, could not warrant the cost of development. But with standardization assuring interchangeability, the entire aircraft industry can immediately avail itself of the new improvement, and the specialty manufacturer has the entire industry as his immediately available potential market.

The practical working of standardization as an aid to change is illustrated in the standard rigid terminal threads on the end of streamline wires used for external bracing on airplanes. Extremely close tolerances, with consequent rigid inspection and selective fitting, are necessary on the threads of both the terminal and wire to assure tight fits, as the vibration of the wire in flight is disastrous with a loose fit. In order to overcome this difficulty, and make all wires and terminals interchangeable by the use of ordinary thread tolerances, the MacWhyte safe lock terminal has just been developed. By the use of a pipe thread on the outside of the right terminal and a similar thread in the locking nut, a tight fit of the terminal on the wire itself is assured at all times. In addition, destroy the threads on the relatively expensive streamline wire, the safe lock nut may be screwed to destruction without injury to the wire threads. With interchangeability assured through standardization, this improvement change is immediately available to the entire aircraft industry, while without it, it would be years before it would be generally available, with a strong possibility that the incentive for its development, as far as a potential market was concerned, would have been small.

A further illustration of the value of standardization in fostering development changes in the aircraft industry is available in the raw material field. Aircraft construction requires materials of great strength and uniformity, with minimum weight and maximum resistance to corrosion. In many cases, this meant the development of new alloys to meet these special requirements. Yet, in all instances the volume of any individual airplane manufacturer was not sufficiently large, in terms of the basic industry, to warrant the development costs. It was only because of the knowledge that, through the established channels of aircraft standardization, such developments would be co-ordinated and made available to the entire industry in one particular analysis, which might be termed an "aircraft grade," that the raw material manufacturers were encouraged to undertake their special development changes. So, too, by means of this standardization, any individual manufacturer of planes could immediately avail himself of the latest improvement, for, without it, the cost of the new material, and the consequent delays in procurement, might well have been prohibitive.

Therefore, in the aircraft industry, standardization has really provided the volume that has made changes worth undertaking. Instead of preventing or retarding change, it has really been instrumental in fostering it, because any given changed part within the scope of its activity could be service tested by actual installation, with a minimum of effort, and on any plane.

Some shops stimulate suggestions from the workmen by putting up definite problems for the men to aid in solving. When you get all the men thinking about improving some one thing, like the handling of material, cutting down the amount of scrap, and such definite problems, you are pretty sure to get some suggestions that are worth while.

The New Industrial Europe

By Dr. Julius Klein
Assistant Secretary of Commerce

General recovery of European manufacturing brings with it a distinct threat of intensive competition, but the ability to absorb certain classes of American equipment has been augmented with the increase in buying power

A WELL-INFORMED observer of European conditions recently declared that the biggest single international problem now confronting the world, the situation most fraught with grave significance for the future, is the economic rivalry between Europe and the United States—the struggle for markets, for communication facilities, for preferred steamship routes, for raw material controls, and for financial footholds. A multitude of ramifications of this problem appears not simply across the Atlantic, but in all parts of the world. They affect every farm and factory in the United States, every worker's home in the old World, the household of every mill hand and peasant in crowded Asia, to say nothing of the ranchmen and miners of South Africa and Latin America.

The leading items of European news these days are very predominantly such topics as the progress of the reparations negotiations, the purchase of European automobile factories by American groups, labor riots in Germany, the European reactions of our tariff and immigration policies. It is of the utmost importance, therefore, that each of these problems should be calmly and intelligently appraised in order that our national thinking and planning may be factual rather than emotional. American bankers and manufacturers, merchants and shippers must, not simply guess at, but know the trend of European credit and competition. They must have all the facts before they can decide such vital questions as those involved in the acquisition of branch factories in Europe. They must know the status of Russian recovery, particularly in its bearing upon buying power and industrial stability in Germany and England.

As for the general recovery of European foreign trade, the figures for 1928 continue to show outstanding progress by France and Italy, both of which have passed the 1913 volume figures and have registered an increase in the value of their exports of 51.6 per cent and 57.7 per cent, respectively. The United Kingdom is still behind her 1913 volume, having registered a value increase in 1928 over the pre-war year of only 31.4 per cent. Germany, if we exclude reparation exports, showed an increase last year of 12.8 per cent over the last full pre-war year, which puts her considerably below her 1913 volume of overseas sales. If we include reparation shipments, her increase in 1928 over 1913 was slightly under 20 per cent. It is significant, incidentally that this grouping of the four major nations as to relative foreign trade improvement corresponds with their respective unemployment situations. That is to say, France and Italy show no slack labor difficulties, whereas the United Kingdom now has over 1.1 million on her unemployment dole list, and Germany shows over 2.2 million unoccupied workers.

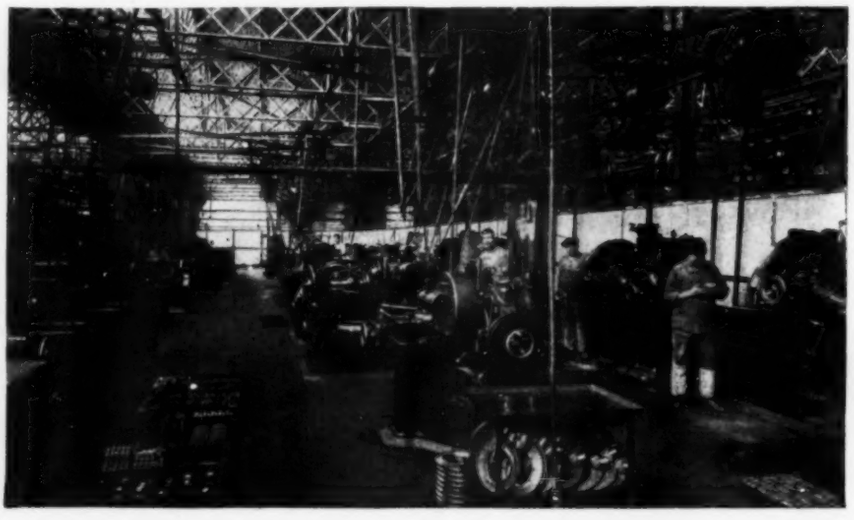
> It is a striking commentary upon the improvement in living standards in Europe and the requirements of her factories for machinery and industrial equipment that our exports of finished manufactures are now more than four times the pre-war level. The universal admiration of American industrial technique and the wide acceptance of American standardization and simplification principles by European executives create unusual opportunities for American manufacturing industries

From the point of view of general trade balancing, the position of France is probably the best of any of the European nations. Her "unfavorable" excess of imports over exports in 1913 was about 300 million dollars, whereas last year it was about 82 million dollars. In fact, her imports have increased since the pre-war year only 28.9 per cent, which is only a little over one-half the rate of expansion of her export trade. In each of the other three major nations the rate of increase for imports has exceeded that in the case of exports. Italy's purchases from overseas have grown nearly 65 per cent in value, England's 64 per cent, and Germany's 30.4 per cent.

With reference to the commercial relations between the United States and Europe, a number of rather significant changes were recorded during 1928. In the first place, the European share of our total overseas sales has declined steadily; whereas during the first decade of this century Europe took about 70 per cent of our total exports, her takings last year were but a little over 46 per cent. The decline in her contribution to our imports was even more drastic, imports having fallen during the same interval from about 51 per cent to 30 per cent of our total purchases from foreign lands.

It is interesting to note that the heaviest rates of increase in our sales to Europe were shown in the outlying sections of the southwestern and northeastern countries—the Iberian peninsula and the Balkan and Scandinavian countries. An important element in this connection was the establishment of direct steamship contacts, which are being utilized in rapidly increasing volume by American shippers. Indeed this point is one worthy of most careful scrutiny on the part of American export interests. Desperate efforts are being made by the older Continental trade centers, particularly in France and Germany, to cling to the trans-shipment business, which have long played such a vital part in their commercial development. On the other hand, the more remote markets of the smaller countries appreciate the value of curtailment in commissions and trans-shipment charges, and consequently their governments are extending preferred treatments of various sorts to this direct commerce.

One angle of the difficulties encountered by American exporters in utilizing the trans-shipping facilities of the Continent is that in many cases they are compelled to observe the various trade restrictions of the country in which the trans-shipment takes place, even though the goods may be only in transit. In this connection, the container marking laws of France, which are in some respects quite drastic, are applied to goods enroute through French ports and trading centers to other countries—a situation that is naturally stimulating direct trading wherever possible.



A view of the gear cutting department of the Peugeot Works, Garenne, France, showing the use of American-made equipment

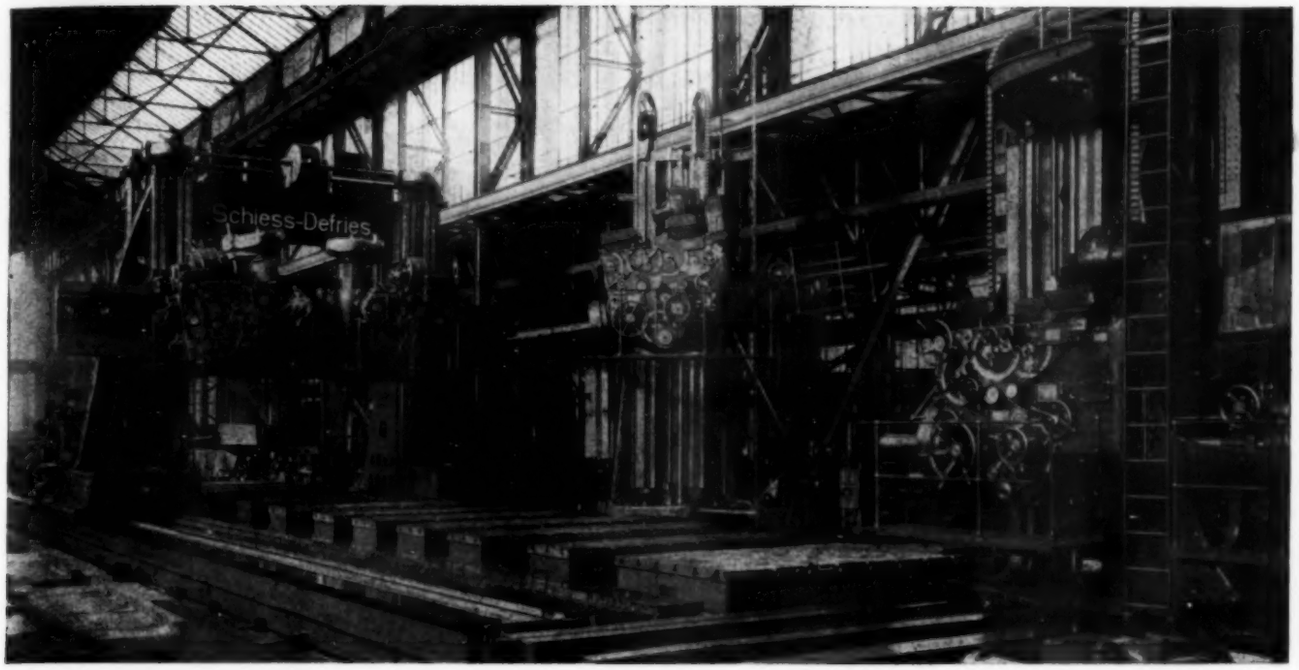
Although the largest single items in our exports to Europe are still made up of crude materials, notably cotton, copper, and petroleum, nevertheless finished manufactures have been going forward so rapidly that they now have taken second place in the four major classes of merchandise, supplanting foodstuffs, which had long been ranking second. It is a striking commentary upon the improvement of living standards in Europe and the requirements of her factories for machinery and industrial equipment that our exports of finished manufactures to the Old World are now more than four times the value of those in 1913, whereas exports of crude materials and foodstuffs recorded in each case a less-than-doubling of their totals.

Before one jumps to the hasty conclusion, therefore, that European and American manufacturers are in deadly combat in their export trades, it is well to note that Europe is still our best market for fabricated wares. She took about one-third of our total overseas sales of that category and a half of our exports of semi-manufactures. It is highly advisable, therefore, for any American manufacturer contemplating export to canvass the prospects for markets in Europe on the very doorsteps of his supposed competitors. Imporved buying power and better conditions of credit have strengthened the potentiality of European demand and have made for distinctly better markets for American quality products. The universal admiration of our post-war industrial technique and the almost blind acceptance of American "rationalization" principles (standardization, simplification, etc.) by Old World executives have combined to create unusual opportunities for American manufacturing industries.

There can be no doubt that the general recovery of European manufacturing brings with it a distinct threat of intensive competition. Even though in the main this does not promise to be as devastating as is commonly supposed, it is nevertheless worthy of careful observation. For instance, the drive against our textiles promises to be unusually strong, especially in the Near East and South America where the desperately tried mills of England and the newly expanded establishments of Italy and France are making most strenuous drives. The latest phase of this is the large combination of Lancashire mills in a sort of Webb-Pomerene group, the chief purpose of which is to modify the cost of financing and eliminate overhead in export efforts. There are also indications of aggressive preparations on the part of Continental manufacturers of cheap hardware and tools.

The Germans are returning to their old export haunts with redoubled vigor. Their recent commercial treaty with the Union of South Africa has amazed British business, particularly because the Germans are now to be given equality of treatment in that rapidly growing market, as against any other traders including the British. German activities in the Lower Danube are also arousing no little concern, especially among the French and Italians. The proposal of German settlements around the Danube Delta and the rehabilitation of certain important trade outlets in Roumania have given further evidence of the unmistakable revival of the old prewar *drang nach Osten*. In this connection it is significant that German trade in Poland is becoming increasingly formidable in spite of the deep-seated German-Polish antipathies and the recent tariff war between the two countries. This is likely to have a significant bearing upon our trade in machinery and textiles.

Anxious observers among Germany's rivals report a renewal of the liberal credit policies so characteristic of her trade before 1914. So far as American exporters are concerned, however, the utmost caution should be observed in this connection before any liberal terms are extended. Buyers, especially through the Near East and



A large horizontal milling machine built in a German shop for shipment to Russia. Its total length is about 100 ft. and the entire weight is around 1,100,000 lb. German machine builders look to Russia as a large outlet for their machinery

in Latin America, are evidently attempting the old game of playing off the alleged long-credit proposals of Germans against our usually restricted terms. On close analysis, it is all too frequently evident that the German liberality is in many cases but a temporary, none too wisely used trade lure, and is not a fixed regular policy.

Italy is aggressively cultivating every possible trade opportunity in Latin America. One prominent Facisti leader has gone so far as to resent the "intrusion" of the United States in these Southern markets "which Providence has chosen for development by Latin races, of which Italy is the chief exponent." In the field of textiles, automobiles, and even electrical equipment, the activities of Italian manufacturers in the Near East will be worthy of special observation. Every effort is being made to revitalize the old classical racial connection with Roumania, and to capitalize the footholds of Italy along the Red Sea.

Indifference to the Apprentice System—*Discussion*

By Charles E. Dawson

Head, Machine Department, Vocational School, Holyoke, Mass.

IN THE *American Machinist*, p. 421, Vol. 70, A. W. Forbes describes the exhibit of apprentice training which his company staged at the Worcester Industrial Exhibition. He states that although crowds of visitors stopped to see the apprentice operate the mechanical-stamping die, took an interest in what he was doing, and read the sign explaining apprenticeship work at the plant, not one inquired for more details, nor asked about requirements for admission. The cause of this indifference Mr. Forbes attributes to disbelief, the same attitude that these people would take toward a man who offered to give away five-dollar bills. To the title of this article "Indifference to the Apprentice System," I suggest that we add the query "Why?"

I am a "graduate" of a regular indentured course of machine shop practice, with all the agreements and promises guaranteeing progress from sweeper to toolmaker, and with a specified time to be spent in each department and on each operation. This apprenticeship plan did not work out in practice as it was outlined in the agreement, simply because, under the stress of production in any one department, the foreman did all he could to hold a proficient boy beyond the assigned time. His interest was production and not trade education.

In the shop, production ruled supreme, and we boys, at times, had to fight for our changes from department to department. The management was, and is, honest in its endeavor to carry out its agreement with apprentices, but circumstances beyond its control, such as short time, pressure of production during good business, the likes and dislikes of certain foremen for individual apprentices, the tendency of some shop men to "cover up" information on certain types of work and methods, and other causes too numerous to mention, continually interfered with the projected operation of the system.

Out of six boys who started with me, two hung on and received their apprenticeship papers, but this willingness to go through with the proposition was, in both cases, fostered in an evening trade school by instructors who developed in us boys an appreciation of the opportunities in the machine business.

A lot of young fellows have received anything but a square deal, as far as apprenticeship training is concerned. Many of these same young men would have made good under a well-planned system of training. We must, therefore, conclude that the cause of disbelief in apprenticeship lies not in the system itself, but in the way it has been generally maladministered.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Paying a Bonus for Temporary Work

"I'M AFRAID I'm going to have some trouble in my department about wages, Al, and it's got me buffaloed," grumbled Ed, one evening as the two foremen friends were out for a spin to enjoy the Spring air.

"What's that, Ed, your errand boy going on strike, or that fair lady in your office been reading about Tillie the Toiler?"

"There's no joke about it at all, Al. It's about the high hourly rate the employment department promised to the extra men we took on during the rush. I knew it would cause trouble when our regular men found it out, and now Bill Kelly, one of my best workmen, got after me this morning."

"Well, what kick did he have? I knew they were paying those extras a bonus pay, because I have a few of them in my own department. But I don't see where the kick comes in."

"No, Al, I suppose your idea is that it was all right to pay the men who came in at the eleventh hour the same as those who labored all day, but I'll bet the fellow who owned that famous vineyard had trouble after a week of that practice.

"Kelly came to me and pointed out that these new men were getting five cents more an hour for doing the same work as he was. Said it didn't seem fair to him to pay a new man more than one who had proven himself and was worthy of being retained even over a period of depression like we had about five years ago."

"Well, what did you say, Ed?"

"All I could say, Al, was what they told me when they sent the men out to the job. That good men for temporary jobs were hard to get and had to be paid extra money. But Kelly wasn't just satisfied with that explanation."

"Maybe that's because you're not sold on it yourself, Ed. But it looks reasonable to me. You know we can get all the fly-by-nights and tramp machinists we want, but you can't ask a good man to tie himself up to an indefinite job that he's apt to lose any old time without paying him a bonus, can you? And it wouldn't be fair for the employment department to promise the man a steady job if they knew it was only temporary.

"Remember, Ed, if you want a good mechanic to fix your car brakes you pay him two dollars an hour on the job, but if you could hire him and keep him busy all day you can get the same man for 75 cents an hour. Looks to me as if the permanent men have to realize that their hourly rate is the normal one, and the special rate is only a bonus. The regulars know that their jobs are good as long as they want to stay and do the work."

Was Kelly right in his complaint that a man so valuable as to be kept during slack times is also more valuable during a rush? Or was Al correct that the extra wages paid temporary men should be considered merely as compensation for the short employment?

Idea submitted by J. Homewood, Instructor, Chaffey Union High School

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Going Over the Super's Head

BLACK was wrong in going over the super's head. The superintendent was apparently a valuable man, or else he would not have held his job as long as he had. He must also have had some good reason for picking out the particular assistant he did, and his judgment must be accepted. It appears to me that it was Black's place to use the man assigned to him and give him a fair chance to prove his worth. If the man then falls down on the job, his next move would be to go to the superintendent and explain the situation. Under no consideration was he justified in taking the step he did.

—E. E. ERBE,
Diamond Power Specialty Corporation.

Letting a Big Order Go Elsewhere

IF A shop has a fair amount of work on hand, with good prospects of more coming in, why should it take on a big rush order which will upset production schedules and regular work? There is always a temptation to push a new order ahead of the work for old customers, and hard feelings, with possible loss of future orders, sometimes results.

When good workmen are hired away from other shops, it is necessary to offer them more than the "going rate" of wages, to induce them to make a change. This means that these newcomers will have a higher rate than many of the old hands, which will cause dissatisfaction unless the pay of the old hand is raised to correspond.

All these things add to the cost of doing the work, and after the big order is completed it is hard to get costs back to the old level. It is usually better to pass up the big special order, and work for a sound, healthy increase by a slow, steady growth. —H. M. DARLING, *Engineer, Wells Tap and Die Company.*

NO MATTER how discouraging the prospect of getting a big job out on time looks before you start, it has been my experience that getting started is half the battle. Trying to do something that looks impossible on the face of it, certainly does bring out the best there is in an organization. While there are usually additional factors arising during the course of the job to delay and handicap you, there is also the fact that there are likewise "breaks" which help to make it easier, if you are alert enough to seize them. It is really surprising what a man and an organization can do when they really have to. So it is my policy never to refuse to tackle a job no matter how discouraging the prospect—this does not mean blindly and enthusiastically agreeing to accomplish everything, but rather presenting the facts and then signifying my willingness to have a go at it.

Perhaps a sudden and temporary expansion like that contemplated would be a boon to the organization in discovering hidden talent. Hiring men at the bottom and moving up the present personnel temporarily may be of real benefit to the organization and the individual. Some of the men thus made "straw bosses" may show up better than the regular bosses, and possibly some of the new men may "knock spots" out of the old timers who may have grown too secure in their jobs. Putting over one big job in a hurry may lead to others, so that the temporary growth will become permanent—so I'm all for trying to put the job over.

—CHARLES E. KIRKBRIDE, JR.,
U. S. Naval Aircraft Factory.

Belts, Foremen, and Paper Work

COMPILED and summarized information from the bookkeeping department has its value in the management of a plant. Information of this kind represents the type of information that must be compiled at all times. But there are times when, in the consideration of detail problems, this information must be supplemented by detail figures accompanied by technical interpretations. Then it is proper to call in the man most eminently fitted for the job, which in the case under discussion is the foreman.

Just because the bookkeeper may allocate the total appropriation among the different shops would not be accepted by the foreman as indicating that the bookkeeper should tell him how to spend every dollar assigned to his shop. The foreman would properly claim that this required expert knowledge? Isn't it equally true that information about belting, and belt repair costs requires the same expert knowledge? So why shouldn't the foreman gather such statistics?

—LEON J. LICHENSTEIN.

Picking Men in Cheerful Surroundings

PLEASANT surroundings for the reception of prospective employees are desirable, but what is more important is the reception itself. Many firms gain a bad reputation by the attitude assumed by the employment manager or his assistants. A surly, indifferent, suspicious attitude towards a person whose desire it is to sell service, which when needed is easily worth the wages asked, is not conducive to good will towards the employment department, or the firm itself. Let me tell of a few undesirables in employment procedure:

The foreman of a shop who is in charge of employment who frowningly shakes his head, or voices a gruff "no" when a prospect starts to ask for employment; The superintendent who shows the applicant the most difficult job in the shop and asks him if he can do it;

The employment manager who tells a clerk to take the applicant's name and address and promptly deposits same in the waste basket; The employer who keeps an applicant waiting for hours; The would-be psychologist who sizes up and decides a man merely on his appearance; The employer who haggles over the rate of pay when he has no intention of employing the prospect, but takes pleasure in seeing how cheap he can get help; The employer who promises to notify a prospect in a day or two when he has no intention of doing so; The employer who does not acknowledge written applications; The employer who advertises for skilled help when he wants a laborer. Industry can well dispense with such people and their methods.

—PHILIP F. SHAFRAN, *Machine Shop Instructor, James Monroe High School.*

IN ALL probability one of the most outstanding qualities of human nature is the desire for a square deal. From the very moment an applicant enters to apply for a position his eyes are open to minor details that the employer would consider trivial. With an appraising eye he notes the condition of the waiting room, its cleanliness, ventilation, seating capacity, and general air of consideration for prospective workers. All these he regards as indicative of the future treatment he will receive when he becomes a member of the organization. Therefore, fitting up an attractive room in which to interview men for employment is a step in the right direction for creating the proper attitude on the part of the employee and properly inducting him into the organization. —HARRY KAUFMAN.

Shall Men Clean Their Own Machines?

THE average man dislikes very much to have somebody else handling his machine. Things are disturbed that should not be; which causes an uncertain feeling when starting up for production. For this reason I favor having the men do the cleaning. This should not include cleaning chips out of screw machines or lathes, nor the changing of cooling compounds. Work of this kind should be done by the maintenance department without interfering with production during working hours.

The cleaning of machinery, and the shop in general varies to some extent with the product. In a shop that makes cutters of all kinds, with which I am acquainted, all of the floors and benches are washed at regular intervals. On the other hand this would be rather extreme where considerable cast iron was machined. A reasonable degree of cleanliness of both shop and machines should not require the attention of the Board of Directors. —L. F. SWANSON, *Industrial Engineer, Perkins Machine & Gear Company.*

I BELIEVE that this question must be left to the judgment of the foreman if he is efficient, and wishes to reduce the overhead in his department.

If the man is running one or more machines, and he has to wait for the machine to perform the operation, and there is no danger of getting hurt, the machine then should be cleaned by the operator without any lost time. But if the operator is a highly paid mechanic, and the machine has to be shut down, and the maximum production has to be obtained, the machine should be cleaned by a helper even if overtime must be paid. If it is necessary for the operator to clean his own machine, and he is a piece-worker, a time study should be made of the cleaning of the machine, and a price given for doing this work.

I believe the same is true of oiling machines, which should receive just as much, if not more, attention than cleaning, although this should not be neglected.

—RUPERT E. KNOX, *Canadian General Electric Company.*

Re-hiring Old Employees

THE fact that a man has left the employ of a firm to seek better opportunities elsewhere is not detrimental to either the employer or the employee but may be a credit to the employer.

A man full of ambition and eager to improve his condition and thereby become more valuable to an employer, should always be welcomed back to a job he has left, provided that he left in a proper manner and there is nothing against his record. —S. C. NIELSEN.

* * * *

THE · NEXT · TOPIC

"Committees for Definite Shop Problems"

Whistling in the Shop

Summary of the Discussion

Ed objects to his men whistling. He says it is annoying, and that it interferes with work. Al takes issue with him and suggests that whistling is a means of blowing off steam, and that it is up to the foreman to see that it does not become a nuisance.

SEVERAL shop executives contributed to the discussion, and all of them expressed the opinion that, in the main, whistling was not objectionable and should not be prohibited. They did think, however, that when it disturbed others or affected a man's work it should be surpressed, but in a polite way. One of them held that an enthusiastic whistler might start off a whole group, but that the responsibility for preventing this lay with the foreman and that he should not interfere otherwise, as it was a safety valve for one's emotions. Another said that too much whistling added to other shop noises, prevented conversation, and in case of an accident might prevent a call for help being heard at any distance.

Another contributor thinks that a whistling man is not a thinking man, but does not object to the practice, as long as it is kept within reasonable bounds. Still another claims that it is neither an evil or a benefit, and that there should be no hard and fast rules regarding it.

Protecting the Workers *in Chromium Plating*

By J. J. Bloomfield
Assistant Physical Chemist, U. S. Public Health Service

and

William Blum
Chemist, U. S. Bureau of Standards

While chrome poisoning from chromium plating is not as dangerous as is sometimes stated, nevertheless it should be prevented by proper exhaust ventilation

PRACTICALLY all of the chromium-plating baths now used have chromic acid as their principal constituent. In addition there are present small amounts of sulphate ions introduced either as sulphuric acid or as a sulphate. Variable amounts of trivalent chromium and of trivalent iron, derived from the iron tanks or anodes, are likely to be present in the used baths. Lead anodes are generally employed, which produce at least small amounts of lead chromate and lead peroxide. Oxygen is evolved on the insoluble anodes and considerable hydrogen is liberated on the cathodes. These gases tend to carry into the room atmosphere a fine mist of the liquid of the tank. Observations indicated, however, that the only constituent of this spray that is injurious is the chromic acid.

Typical exhaust ventilation connections for a chromium plating bath. The poisonous chromic acid spray is not permitted to pass the face of the workman

Efficient ventilating systems are very necessary. Impermeable gloves, anointing of the face, hands and nose with vaseline, proper working suits and caps, frequent baths, and changes of clothing upon cessation of work are recommended. Most important is medical inspection of the slightest skin affections as soon as they occur. Without such attention it does not seem possible to prevent the occurrence of chrome ulcers and their development.

It is obvious from a discussion of the literature on chrome poisoning, however, that the injury arising from contact with chromic acid solution or spray does not develop into a constitutional disease. Ulceration and perforation of the septum of the nose, as well as the formation of "chrome holes" on other parts of the body, are not in themselves a grave matter, and seldom are severe enough to necessitate absence from work. However, these chrome sores are very slow to heal, and at times impair the efficiency of the worker and lower the general morale.

In practically all of the plating rooms visited in the investigation the method of removing the acid mist was by drawing air laterally across the tanks. The most common place of injury to the workman is the nose, and experience has shown that vertical ventilation as employed in most hoods is ineffective, as it draws the spray directly past the face of the operator who is working over the tank. In the actual examination of workers in chromium plating departments with improper exhaust ventilation it was found that even helpers working ten feet away from the tank were injured in the nose and had ulcers, and that more than half of the workers suffered from frequent nosebleed and had chrome holes on the hands.

Even though this survey was not extensive, the results obtained in different plants were so consistent, and agreed so well with previously recorded experiences upon the effects of chromic acid and chromates, that the following conclusions and recommendations appear warranted:

1. Natural ventilation is seldom, if ever, adequate to remove the chromic acid spray produced during chromium plating.

2. Vertical ventilation, such as is commonly used in chemical hoods, is ineffective because it draws the chromic acid spray past the face of the operator who is working over the tanks.

Abstract of Public Health Reports, United States Public Health Service, pages 2330-2347.

3. It is feasible by a properly designed system of transverse ventilation, with an adequate air velocity, to reduce the content of chromic acid to less than 1 milligram in 10 cubic meters of air.

4. Continuous daily exposure to concentrations of chromic acid greater than 1 miligram in 10 cubic meters is likely to cause definite injury to the nasal tissues of the operators.

5. The most efficient method of ventilation is to draw the air laterally across the top of the plating tanks into ducts from 1 to 2 inches wide and extending fully along one or more sides of the tank.

6. To be effective, the duct should not be required to draw the air a lateral distance of more than 18 inches. For wider tanks there should be ducts on both sides, or else two ducts in the center.

7. The level of the plating solution should be at least 8 in. below the top of the tank and the duct should be at the top of the tank.

8. For effective ventilation it is necessary to have an air velocity at the duct of about 2,000 feet per minute.

9. Care should be taken to avoid obstacles to the air current, such as large projecting anodes or racks.

10. A hood surrounding one or more sides of the tank may be advantageous in protecting against disturbance by other air currents, such as those from open windows or from other fans.

11. The operators should guard against injury to the nasal tissues by applying to them, several times daily, vaseline or mentholatum salve.

12. Rubber boots, gloves, and aprons should be used when feasible, to prevent contact of chromic acid with any abraded skin.

13. If gloves are not used, the hands should be washed frequently with water, and all cuts or abrasions greased with a mixture of three parts vaseline and one part lanolin.

14. All floors near the plating tanks should be frequently washed down.

15. Operators should have periodic medical examinations, with prompt treatment of the slightest skin or nose affections, not permitting them to develop.

Using Mathematics in the Shop

With the aid of simple geometry and some trigonometry Professor Buckingham will show in an early issue how the distorted forms of relieving tools for formed milling cutters may be readily calculated. He offers this method in place of the common one of "back generating," often requiring the use of three or more intermediate tools to obtain the results.

Proposed Standardization of Engineering Symbols

Through the sectional committee on scientific and engineering symbols and abbreviations of the American Standards Association, a proposed tentative American standard on Symbols for Mechanics, Structural Engineering and Testing Materials, designated as A.S.A. Z10a—1929, has been published for criticism and comment. Remarks should be addressed to Preston S. Millar, secretary of the sectional committee, Electrical Testing Laboratories, 80th St. and East End Ave., New York City. The list of recommended symbols is given here.

Acceleration, angular	α (alpha)
Acceleration, due to gravity	g
Acceleration, linear	a
Angular distance	θ (theta)
Angular velocity	ω (omega)
Area	A
Axis, through c. of g.	X-X Y-Y
Axis, not through c. of g.	N-N
Moment of force, including bending moment	M
Breadth	b
Center of rotation	O
Coefficient of sliding friction	μ (mu)
Concentrated load, no symbol required since F (force) is available	none
Constants	C
Curvature, radius of	ρ (rho)
Deflection	y
Density	none
Depth	d
Diameter	D
Distance, linear	s
Distance, neutral axis to extreme fiber	c
Eccentricity of application of load	e
Efficiency (hydraulic, mechanical, volumetric)	e_h, e_m, e_v
Elasticity, modulus of	E
Elongation	δ (delta)
Force	F
Frequency (harmonic motion)	none
Gyration, radius of	k
Head	H
Height	h
Horsepower	P
Hydraulic radius	R
Impulse	none
Inertia, rectangular moment	I
Inertia, polar moment of	J
Length	L
Linear velocity	v
Load, unit	w
Load, total, no smybol required since F (force) is available	none
Mass	m
Modulus of rupture	none
Modulus of section	Z
Number of revolutions per unit of time	n
Period (harmonic motion)	none
Pitch	none
Pressure	none
Quantity of liquid flowing	none
Radius	r
Reactions	R
Specific gravity	none
Stress, unit	s
Temperature	none
Thickness	none
Time	t
Torque	T
Velocity	v
Volume	V
Work, or energy	W

Fire and Health Precautions

For the Spray-Coating Process

By Joseph B. Ficklen

Chemical Engineer, Engineering and Inspection Division
The Travelers Insurance Company

Properly designed booths and adequate ventilation are necessary to reduce the fire and health hazards created by the inflammable vapors given off by the usual solvents

According to a recent estimate, 75 per cent of all the surface-coated articles manufactured in the United States are now finished by the spray method, and more than half of the paint and varnish made in this country is applied in this way. As a rule, lacquers, paints, enamels, varnishes, and stains are diluted (or "thinned") in order to facilitate their free passage through the spraying device, and thus make it possible to apply the material rapidly and uniformly. In order to keep pace with the speed demanded in mass production, it has been found necessary to have a large portion of this thinner or solvent of a highly volatile nature, so that it will evaporate quickly and leave the finished object thoroughly dry. The spray method facilitates the release of these vapors and particles from any inflammable or poisonous substances that may be present in the coating material, and for this reason, if the proper precautions are not taken, the hazard of fires and explosions, and the possibility of ill effects on the health of the workmen, are greater in connection with the spray process than with dipping and hand-brush methods.

> Good housekeeping is an important means for preventing fires that might be caused by pyroxlyn-lacquer residues, and by the spontaneous ignition of waste deposits of varnishes and other resinous materials. Care should also be taken in the storing and the mixing of the coating materials, preferably in other buildings entirely separate from the shops

The vapors given off by most thinners or solvents of coating materials may form explosive mixtures with air when present in even such small quantities as 4 per cent. or less, by volume. Moreover, it has been definitely determined that the vapors from some of the ingredients of the thinners are capable of producing severe physical distress (and perhaps chronic or fatal illnesses) when present in rather low concentrations. If a lead-base paint or silica enamel is sprayed, the additional health hazards of lead poisoning and silicosis, respectively, are created; and when pyroxylin lacquers are sprayed, it is necessary to consider the possibility of an accumulation of dry pyroxylin residue, much of it in the form of dust, in the vicinitiy of the spraying operations. Dry pyroxylin dust not only presents a serious flash-fire hazard, but also, when suspended in the air in suitable proportions, may explode violently, if ignited.

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Moreover, the "setting" or drying of varnishes and other resinous finishes is accompanied by the oxidation of some of their constituents, and an appreciable amount of heat is evolved during this oxidation. Where varnish or other residues are allowed to collect, this heat of oxidation cause spontaneous ignition of the residues.

However, means and methods have been devised for handling and applying the coating materials, which, if adopted and intelligently and conscientiously used, will greatly reduce the likelihood of realizing any of these harmful results. In other words, the dangers involved in the spray process are not due to the inherent hazards necessarily associated with the coating materials or their compounds (although these should be fully recognized), so much as they are to the use of improper methods in applying them.

From a common-sense point of view the possible existence of these hazards indicates the necessity for two accident-prevention measures of major importance: (1) the provision of adequate ventilation in the immediate vicinity of the spraying operations, so that under ordinary and reasonable conditions it will be impossible for the vapors or dust to accumulate to such an extent as to reach a concentration sufficient to produce a fire or explosion; and (2) the effective isolation of all active or potential sources of ignition (such as open flames, coal stoves and other heating appliances, and sparking or spark-producing electrical devices), by removing them to a safe distance, inclosing them, or otherwise safeguarding them so that there may be no recognizable possibility of igniting any explosive mixture that might be generated or attained in consequence of failure of the ventilating apparatus. These two protective measures are commonly employed in actual practice by progressive concerns.

Nearly all commercial spray booths are provided with ventilating apparatus of such capacity that the average concentration of vapors in the booths and ducts will be limited to approximately one one-hundredth of the minimum explosive concentration, so long as the equip-

ment is maintained at its original working efficiency. In the installation of spray booths for maximum safety, each booth and its ventilating system should be a separate unit. The practice of having a number of ventilating ducts exhaust into a main header should be discouraged, because if a fire were to break out in one unit, this general exhaust system might furnish a favorable medium for the spread of disaster, even though each individual booth were provided with its own separate damper and cut-off.

The safest ventilating method is the induced or siphon type—that is, one in which the motors, controls and *fans* are entirely outside of the booths and ducts. Another highly efficient system is the so-called direct system, in which the fan is inside the booth or duct, but the motor and its controls and the fan bearing are located outside of the booth and ducts. With this arrangement the motor is connected to the fan either by an extended shaft or a belt. Any system in which a fan and its driving motor are both inside of the duct, is too dangerous to be countenanced.

Provision of adequate ventilation in the immediate vicinity of the spraying operations so that there will not be an accumulation of vapors in sufficient quantity to produce an explosion, and the effective isolation of all active sources of ignition are two protective measures employed

In considering ventilation problems it should be remembered that the vapors of the solvents are heavier than air, so that under favorable conditions they tend to collect in low areas —such as basements or other locations below ground level. For this reason, it is inadvisable to do spray-coating in basements, or to carry it on near pits or other depressions. However, even these unfavorable conditions can be mitigated to a great extent by the use of suitably located ventilating equipment of adequate capacity.

The ventilating ducts should lead in as direct a course as possible to the discharge point—preferably situated above the roof. The avoidance of changes in the direction of the ducts tends to reduce friction, and hence increases the over-all efficiency of the ventilating equipment. Straight runs also facilitate cleaning, which should be done periodically.

No active sources of ignition should be allowed to remain in the vicinity of spraying operations—it is highly advisable to have them physically separated, either by placing them in a separate room or on another floor. Electric motors that are not vapor-proof should be replaced by others of either a vapor-proof or squirrel-cage type. All switches and fuses situated near spraying operations should be vapor-proof. Of course, smoking near any place where inflammable vapors may be present is highly dangerous and should never be allowed under any circumstances.

Electricity should be used exclusively for artificial illumination. Lamps installed in the vicinity of the spraying operations should be provided with vapor-proof globes, and be further protected by wire guards wherever there is danger of breakage. Electric motors should be provided with overload-release devices, and their frames and other non-current-carrying parts should be grounded. The grounding of shafting and pulleys is essential also, as well as the use of methods and devices for preventing or eliminating static charges on belts, where there is a possibility of a static spark producing a flash-fire or explosive. Grounding of metal booths, mixers, and pumps, is also recommended, because of the possibility of static charges being generated on the metal surfaces.

Good housekeeping is a most important means for preventing fires that might be caused not only by pyroxylin-lacquer residues, but also by the spontaneous ignition of waste deposits of varnishes and other resinous finishes. Various methods have been devised to keep booths, floors, ducts, and other equipment clean.

The more efficient methods for keeping booths clean are as follows:

(a) Hanging sheets of heavy wrapping paper on the parts of the booths that are exposed to the flying spray, and removing these sheets before appreciable amounts of lacquer base or other material have accumulated on them.

(b) Coating the interior of the booth with whiting, and subsequently scraping it clean with non-ferrous hoes or scrapers.

(c) Coating the booth with a hard-drying liquid soap—and subsequently removing the coating with hot water or steam.

A survey of a large number of spraying operations seemed to indicate that the first of these methods is by far the most popular and efficient.

Floors of booths may be kept clean by covering them with paper, or by scraping them with bornze or copper implements. An effective method, where floors of waterproof material and suitable drainage facilities are provided, is to wash the floors with water after scraping them.

The interior of the ventilating ducts should be thoroughly wet down before cleaning. Even under the most favorable conditions, however, it is hard to clean ducts thoroughly, and therefore measures should be adopted to prevent, as far as possible, the residue from the spraying operations from entering the ducts. This may be partially accomplished by installing removable baffles in the rear of the booth proper, and taking them down periodically for cleaning. An inexpensive and effective method that has been used in some cases, consists in the installation, in the rear of the booth, of a screen composed of coarse-mesh wire netting, secured to a suitable frame. This screen is covered with a layer of sea-weed which after serving as a filter can be easily removed from the screen and destroyed.

Under no circumstances should a booth that has been used for pyroxylin-lacquer work be employed for varnish or other resinous-coating work, until it has been thoroughly cleaned. Pyroxylin residue ignites more readily than resinous material. Therefore, if pyroxylin residue were in contact with varnish residue, it might ignite spontaneously (as the result of the oxidation of the varnish residue) at a temperature that would have no effect on the varnish residue alone. *By far the best arrangement is to have a different booth and a different location for each type of material sprayed.*

Good housekeeping principles should be considered to apply also to the storage and mixing of the coating mate-

rials. In the liquid state, in cans or other containers, inflammable coating materials of various kinds present hazards of quite similar degrees. These hazards, as a whole, are far from being negligible, but their nature is at least fairly well understood by most users of the substances. When large quantities of these materials are to be kept on hand, they should be stored in a special house or room of fire-resisting construction, preferably entirely separated from other buildings.

Under no circumstances should more than ten gallons or one day's supply of the coating material be kept in the near vicinity of the spraying operations. In plants where very small quantities of coating materials are used, metal cabinets may be provided for the storage of the containers. These cabinets should be situated at a safe distance from the location where the spraying operations are conducted and from active sources of ignition, and in such a position that they will not obstruct the exits from the spray room.

Open containers (whether filled, partly filled, or discarded) of inflammable materials should not be allowed to remain in the vicinity of coating operations. In case the vapors issuing from the containers should become ignited, the substances in the containers would furnish a supply of highly combustible material. Soaking the spray gun in a highly volatile or inflammable solvent contained in an open tank or vessel, is a dangerous practice and should be prohibited. This method of cleaning should never be employed unless a *closed* container is used, or the cleaning fluid has a flash point appreciably higher than the ordinary room temperature.

The careless handling and disposal of scrapings and sweepings, and of wiping rags, cloths, or other materials impregnated or spattered with coating residues, may also result in fire and consequent loss. Metal receptacles with self-closing covers should be provided for the disposal of any material of this nature, and the contents of these cans should be wet down, and disposed of outside of the building.

Overalls and other articles of apparel worn by spray-gun operators and other persons handling spraying materials, should be laundered frequently. They should not be left lying about in piles (on account of the danger of spontaneous ignition), but should be hung up in well ventilated fireproof lockers.

Sprinkler Protection

Booths and ducts, as well as the spray room itself, should be protected by an automatic sprinkler system. The sprinkler heads in the booths and ducts are likely to become "loaded" with accumulations of coating residues which may prevent them from opening. Heads so exposed should be of the quartz-bulb type and should be cleaned at frequent intervals. Care should be taken to provide an adequate and dependable supply of water at a suitable pressure, so that in case a large number of sprinkler heads were to open at one time, plenty of water would be available for those directly covering the fire area.

First-aid fire appliances—such as small hose, soda-and-acid extinguishers, and approved chemical tanks mounted on hand trucks—should also be provided. Foam-type and liquid carbon-dioxide extinguishers are specially effective in extinguishing fires in open containers of inflammable liquids. The use of hand extinguishers may be rather hazardous, however, because a fire in a spray room is likely to spread with great rapidity and may prevent the escape of the operators of the extinguishers.

A survey of fire records reveals that, in general, properly installed sprinkler systems have proved effective means for limiting and controlling fires in spray-coating occupancies.

The importance of providing adequate exit facilities for emergency use, and for preventing them from becoming obstructed in any way, deserves special emphasis. Many times, considerable quantities of finished or unfinished material are allowed to accumulate near spraying operations. As a result, employees, in case of emergency, may find their escape from the rooms seriously hampered or entirely prevented. The storing or piling of material in such a way as to obstruct emergency exits, and doors or windows leading to fire-escapes, should be absolutely and unconditionally prohibited.

There should be at least two exits from the vicinity of the spraying operations. They should be situated in different parts of the room, and be located, as nearly as can be determined, so that they will not be cut off in case of a flash-fire. All doors leading from the spraying room should be made to open *outwardly*.

Only vessels of approved design and construction should be used as paint-supply tanks for spray guns, and all such vessels should be equipped with reducing valves and relief valves that will prevent over-pressure.

Health Hazards

The hazards to health in spray-coating processes are chiefly associated with the use of the following substances employed in compounding various finishing materials:

1. Lead
2. Free silica in the form of quartz
3. Solvents and thinners that give off poisonous vapors
4. Certain liquids that produce skin affections or burns.

Lead is one of the more dangerous substances that may be contained in coating materials. Lead poisoning (both chronic and acute) has been observed and studied for many years in the various trades employing this metal or its compounds, and marked progress has been made in correcting practices and conditions that bring about undue exposure of the workmen.

Although it appears that the use of lead salts has been discontinued in the manufacture of the majority of coatings for interior work, they are still employed in small quantities as pigment material for certain colored coatings, and in far larger quantities in various exterior-surface coatings. It is therefore evident that the lead-poisoning hazard has not been entirely eliminated from the spray-painting industry.

There is a considerable potential hazard in the spraying of enamels and other coatings containing silicious materials. The finely ground silicious particles are hard and sharp-edged, and are light in weight in comparison with particles of other coatings. In fact, they may remain in suspension in the air of the workplaces and are likely to be inhaled by the workmen, unless suitable preventive measures are taken. Continued inhalation of the particles may produce an affection of the lung tissue which may lead to silicosis and this, in turn, may be followed by tuberculosis. (The same danger may also be present when using the sand blast for removing old paint or varnish, when preparing objects for refinishing.)

Considerable amounts of solids of any kind from coating materials are likely to be detrimental to health when taken into the human system. Some of the substances may not be inherently harmful in the sense that they

are poisonous or irritating, but they may cause serious trouble by impairing the proper functioning of the respiratory and digestive organs.

Some of the volatile solvents and thinners used in coating materials give off vapors that may be harmful to health, if present in the air in sufficient quantity. Formerly, benzol was the chief source of danger in this respect, but the use of benzol has been almost entirely discontinued in high-grade finishing materials. However, toluol, butyl alcohol, gasoline, turpentine, xylol, ethyl acetate, and amyl acetate are among the liquids now employed as solvents and thinners, and new substances are being introduced from time to time, which may be harmful.

The dangers to health associated with the use of substances containing lead, silica, and other solid materials, as well as those that give off harmful vapors, may be combated and to a great extent eliminated: (1) by employing properly designed and constructed spray booths whenever possible, (2) by providing adequate exhaust ventilation in all other cases, (3) by using efficient respirators when needed, and (4) by insisting on measures that will promote personal cleanliness among employees.

Proper Booth Construction Necessary

In order to afford the greatest possible protection to the workmen, all indoor spraying should be done in properly designed and constructed booths provided with suitable exhaust ventilation. If the size of the objects to be sprayed makes the use of booths impracticable, however, or the operations are intermittent and the total quantity of the coating material used is small, the work may be conducted in special properly ventilated compartments or rooms, provided all the conditions are in conformity with fire-prevention and health-protection requirements.

The best arrangement is that by which the objects to be sprayed are passed through a completely inclosed booth, by a conveyor or other mechanical means, and during their passage are coated by an automatically controlled spray gun, situated as far as possible from the opening through which the objects enter the booth. Another safe arrangement is that in which a glass window, through which the spraying operation may be observed, is set in the side of a totally inclosed booth, and the operator directs the spray gun by reaching through a hole in a curtain below the window. The use of equipment of these kinds is limited, however, by practical considerations.

A booth of the type now commonly employed, is inclosed on the top and three sides—the operator standing at the open side. The booth should be large enough to completely inclose the object to be sprayed. The operator should at all times keep the spray gun between himself and the exhaust opening, so that all the spraying material will be carried *away* from him. This may be accomplished by installing a turntable in each booth, on which the objects to be sprayed are placed—the turntable being revolved as the work proceeds, so that the operator will be able to remain near the open front of the booth, where a stream of fresh air constantly enters.

Care should be taken to see that the air that is exhausted from the booths is replaced by *pure* air (rather than by vitiated air drawn from a room containing fumes from other processes), and special ducts should be installed to bring in the fresh air, if necessary. It is not advisable to open windows near the front of a booth, because the air entering through them is likely to set up cross currents which will reduce the efficiency of the exhaust system.

Respirators may be required when indoor spraying is done without a booth and without adequate ventilation, and under other special conditions.

The respirators in common use are of two general types—the positive-pressure type and the filter type. The filter-type respirator is more commonly used (although it is not necessarily the more efficient), and when properly designed and constructed usually protects the wearer quite well against the possibility of inhaling *foreign particles* held in suspension in the air. However, the continued effectiveness of the respirator depends upon the renewal of the filtering medium at suitable intervals.

Filters of fabric or paper afford little or no protection against *vapors*, however, and therefore respirators or helmets of the hose type, or respirators or gas masks containing activated charcoal, which absorbs the vapors, must be used where harmful solvents are employed.

The choice of a general type of respirator (or of a particular brand or style) for protection against either solid particles or vapors, should be made only after a thorough study of all the conditions in the plant where they are to be used. Each respirator of the filter type should be carefully fitted to the face of the individual wearer, because if any small openings are left, unfiltered air will enter through them and be taken into the respiratory organs. Furthermore, it is important for each workman to have his own respirator, because colds and other more serious ailments may be transmitted from one man to another when a single respirator is used by several different persons. Every respirator should be thoroughly cleaned and sterilized at frequent intervals.

Personal Cleanliness Important

Personal cleanliness has long been recognized as of prime importance in connection with operations necessitating the handling of lead compounds in any form. The spray-coating process is no exception to this rule, where it involves the use of lead pigments or other poisonous materials. When practicable, gloves should be worn. Chewing tobacco and gum, and putting the hands to the mouth, should be avoided during working hours, because lead salts or other noxious substances are quite often taken into the system in these ways. Every workman engaged in spray finishing should invariably wash his hands *and face* thoroughly, before eating his lunch. No food should be taken into the workroom, nor should lunch boxes be left where dust is likely to settle on them. Furthermore, the workmen should change their outer garments, at least, before leaving the shop or plant, and should have their working clothes laundered frequently.

Turpentine, gasoline, and some other liquids used as thinners and cleaners may cause rashes and other affections of the skin. Cleaning the hands with these liquids should be discouraged in every way possible, and when it is done it should be followed by the use of soap and water (to make sure that all the solvent is removed) and finally by an application of bland grease or oil. (The substance so used should be selected by a physician, so that it may be appropriate to the type of irritation.) Furthermore, unless similar protective treatments are applied frequently, continued contact with these thinners and cleaners, even though it does not produce actual rash, is likely to make the skin harsh and dry, and lesions may develop and become infected.

Building Welded Tools on Standard Time

By J. J. Huber

Chief Tool Designer, Westinghouse Electric & Manufacturing Company

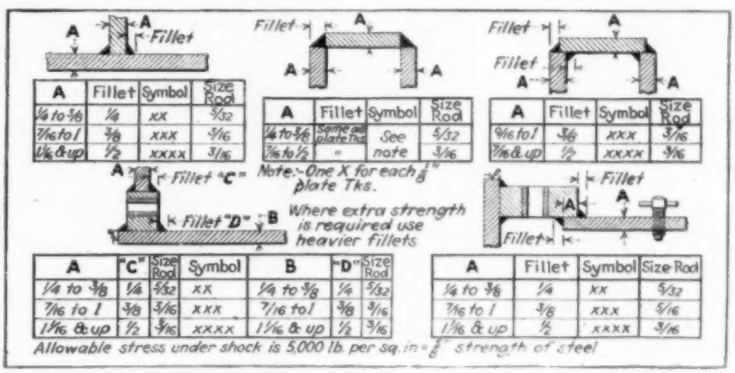
The time for cutting the parts from plates and bars and welding them together is computed by time-study men

HAVING established the superiority of welded jigs and fixtures over the cast and built-up type, in cost, lightness, upkeep and rapid production, the next step was to produce them on a standard time-basis in line with the machining and fitting operations in the toolroom. A special department was fitted up for the work, and time-study men accumulated and formulated the data for estimating the time for the fabrication.

The personnel of the special department comprises a leader, a layout man, an acetylene cutter, a material handler, fitters (who assemble and tack-weld the parts together) and arc welders. The work of the material handler is to see that all parts from the cutter and others are delivered to the fitter. This group works on the standard-time, group-method basis.

An essential requirement, however, was to standardize welding terms and applications for the tool designer, as shown in Fig. 1, in which is given the size of fillet, or weld, to be made for the various thicknesses of plate used in the construction of the tools. Each size of fillet is represented on the tool sketch by a symbol, the letter *X* being used for each $\frac{1}{8}$ in. Thus *XX* will denote the size of fillet to be made on a $\frac{1}{4}$-in. plate. The length is specified on the welding sketches.

It is also important that the tool designer shall confine the material to be used in his design to the shapes and sizes carried in stock in the welding department, as shown in Fig. 2. The advantages of being guided by this list are obvious, saving waiting time on the delivery of special-sized stock that might otherwise have had to be requisitioned from other stockrooms.


Fillet
A
Fillet "C"
Fillet "D"
B
Note:-One X for each ⅛" plate Tks.
Where extra strength is required use heavier fillets
Allowable stress under shock is 5,000 lb. per sq. in. = ⅛" strength of steel

A	Fillet	Symbol	Size Rod
¼ to ⅜	¼	XX	5/32
7/16 to 1	⅜	XXX	5/16
1 1/16 & up	½	XXXX	3/16

A	Fillet	Symbol	Size Rod
¼ to ⅜	Same as plate No.	See note	5/32
7/16 to ½	"		3/16

A	Fillet	Symbol	Size Rod
9/16 to 1	⅜	XXX	5/16
1 1/16 & up	½	XXXX	3/16

A	"C" Size Rod	Symbol	B	"D" Size Rod
¼ to ⅜	¼	5/32 XX	¼ to ⅜	¼ 5/32
7/16 to 1	⅜	5/16 XXX	7/16 to 1	⅜ 5/16
1 1/16 & up	½	3/16 XXXX	1 1/16 & up	½ 3/16

A	Fillet	Symbol	Size Rod
¼ to ⅜	¼	XX	5/32
7/16 to 1	⅜	XXX	5/16
1 1/16 & up	½	XXXX	3/16

Fig. 1—Sizes of fillets to be used in welding various members of jigs and fixtures. The sizes of fillets are determined by the thickness of the two adjoining sections and are denoted by the letter X or multiples thereof. Each letter X denotes an increment of ⅛ in. in thickness

BOILER PLATES

Tks	Width	Length	P.D. Spec.
⅜	48	168	No. 1607
½	60	168	" "
⅝	"	168	" "
¾	"	168	" "
⅞	54	150	No. 3859
1	50	160	" "

H.R.S. PLATES P.D. SPEC. No. 2950

Tks.	Width	Length	Tks.	Width	Length
1¼	48	96	2½	48	96
1½	48	96	2¾	48	96
1¾	48	96	3¼	50	72
2¼	48	96	4¼	50	50

ROUND H.R.S.

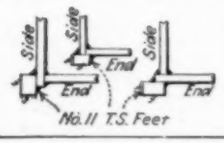
Diam.	P.D. Spec. No.	Diam.	P.D. Spec. No.
¾	No. 1555	2	No. 1555
1	" "	2¼	No. 2162
1¼	No. 2162	2½	No. M22
1½	No. 1555	3	" "
1¾	No. 2162	3½	" "

No. 11 T.S.P.D. SPEC. No. 2663

Tks.	Width	Tks.	Width
½	1	¾	¾
½	1½	¾	1¼
		¾	2
⅝	1	1	1
⅝	1½	1	1½
⅝	2	1	2

RECTANGULAR H.R.S. P.D. SPEC. No. 1555

Tks.	Width	Tks.	Width
⅜	¾	⅝	2
⅜	1	⅝	2½
⅜	1½	⅝	4
⅜	2	¾	¾
⅜	3	¾	1¼
⅜	4	¾	½
½	¾	¾	2
½	½	¾	3
½	2	¾	4
½	3	1	1
½	4	1	1½
		1	2½
⅝	1¼	1	4

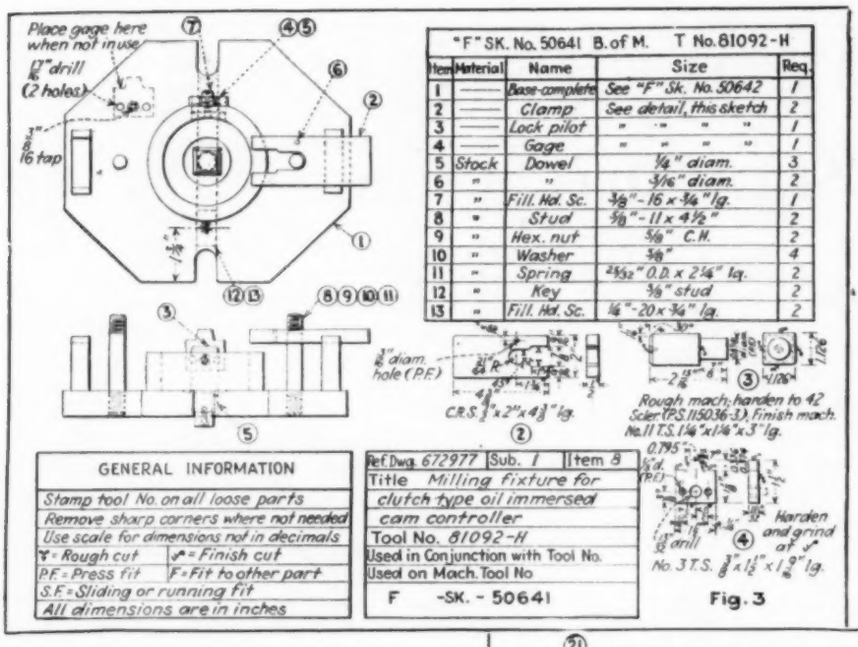


Above material is carried in stock in tool welding department and should be used where possible.
When above bar sizes do not cover detail parts, some should be burned to suit, from H.R.S. plates.
Drill jigs, where drilling is from 2 or more sides and the weight is more than 15 Lb., should have feet made of No. 11 tool steel.
Drill jigs for one way drilling can be made complete from H.R.S.

Fig. 2—Material to be used in making welded jigs and fixtures. The materials listed on this sheet are carried in stock by the welding department. Its use by the tool designers confines their designs to material always on hand and prevents the delays incident to waiting for stock that otherwise might have to be requisitioned elsewhere

The work in progress moves rapidly through the department, for while one piece is being laid out, another is being burned to its lines, and the bar stock is being cut off in the power hacksaw.

Referring to the milling fixture shown in Fig. 3, the absence of welding information on the drawing should be noted. However, reference to the sketch for the welded part is given in the bill of material, in the upper right-hand corner. This sketch (No. 50642), Fig. 4, is forwarded to the welding department by the tool-department production-clerk in the same manner as he would order a pattern or a casting. The time-study man in the welding department computes the time for laying out, drilling the start holes, tack-welding or assembling, and the final welding, from standard


Place gage here when not in use
17/64" drill (2 holes)
3/8-16 tap
3/4" diam. hole (P.F.)
C.R.S. 1/2" x 2" x 4 3/8" lg.
Rough mach; harden to 42 Scler (P.S. 115036-3), finish mach.
No. 11 T.S. 1 1/4" x 1 1/4" x 3" lg.
0.795
1/4" d. (P.F.)
Harden and grind at
No. 3 T.S. 3/8" x 1 1/2" x 1 9/16" lg.

"F" SK. No. 50641 B. of M. T No. 81092-H

Item	Material	Name	Size	Req.
1	——	Base-complete	See "F" Sk. No. 50642	1
2	——	Clamp	See detail, this sketch	2
3	——	Lock pilot	" " " "	1
4	——	Gage	" " " "	1
5	Stock	Dowel	1/4" diam.	3
6	"	"	5/16" diam.	2
7	"	Fill. Hd. Sc.	3/8"-16 x 3/4" lg.	1
8	"	Stud	5/8"-11 x 4 1/2"	2
9	"	Hex. nut	5/8" C.H.	2
10	"	Washer	5/8"	4
11	"	Spring	25/32" O.D. x 2 1/4" lg.	2
12	"	Key	3/16" stud	2
13	"	Fill. Hd. Sc.	1/4"-20 x 3/4" lg.	2

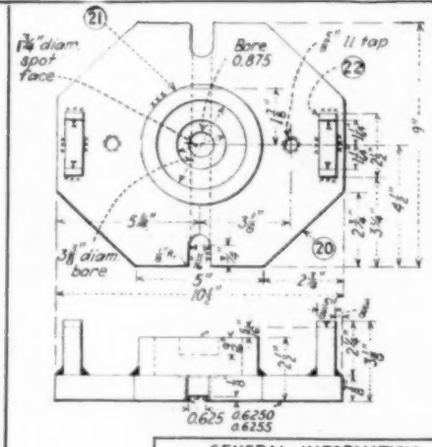
GENERAL INFORMATION	
Stamp tool No. on all loose parts	
Remove sharp corners where not needed	
Use scale for dimensions not in decimals	
▽ = Rough cut	▽▽ = Finish cut
P.F. = Press fit	F = Fit to other part
S.F. = Sliding or running fit	
All dimensions are in inches	

Ref. Dwg. 672977	Sub. 1	Item 8
Title Milling fixture for clutch type oil immersed cam controller		
Tool No. 81092-H		
Used in Conjunction with Tool No.		
Used on Mach. Tool No.		
F -SK. - 50641		

Fig. 3

Fig. 3—The sketches of jigs and fixtures do not, as a rule, carry the details of welding information. Reference to the sheet on which this information is to be found is included in the bill of materials, located in the upper right-hand corner of the sketch

Fig. 4—In the jig base shown in this illustration, the time-study man gets his information regarding the depth of torch burning from the bill of material and the length of cut from the detailed parts. The time for fabrication is computed and will be found in the square containing the title, in the lower right-hand corner



"F" SK. No. 50642 B. of M. T No. 81092-H

Item	Mat'l.	Name	Size	Req.
1	——	Base-complete	Items No. 20 and 22	1
20	Bl. Pl.	Base plate	Burn from 1" plate	1
21	H.R.S.	Seat	See detail this SK.	1
22	H.R.S.	Clamp seat	5/8" x 2 1/2" x 2 1/4" Lg.	2

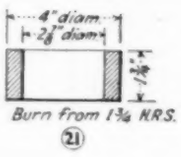


Fig. 4

GENERAL INFORMATION	
Stamp tool No. on all loose parts	
Remove sharp corners where not needed	
Use scale for dimensions not in decimals	
▽ = Rough cut	▽▽ = Finish cut
P.F. = Press fit	F = Fit to other parts
S.F. = Sliding or running fit	
All dimensions are in inches	

WELDING AND MACHINING SK
Anneal, shot blast & paint after welding
Weld full length unless otherwise specified
Total length (1/4) xx fillet —
Total length (3/8) xxx fillet 25
Total length (1/2) xxxx fillet —
Assembly SK. No. F-50641
F -SK. - 50642

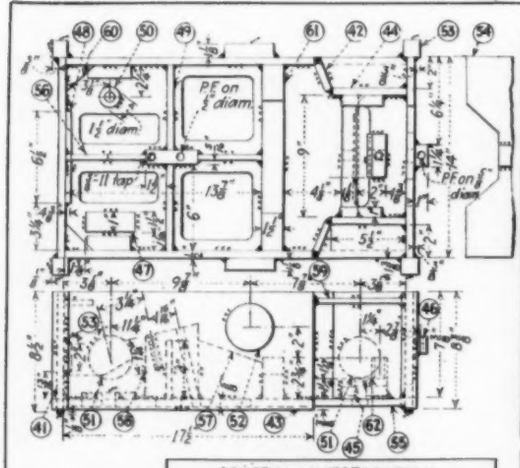


Fig. 5

Swgr. SK No. 1-A-984 B. of M. T No. 81101-R

Item	Mat'l	Name	Size	Req.
1	——	Body complete	See items No. 41 to No. 62	1
41	Bl. Pl.	End wall	9 3/8 x 14" burn from 1/2" plate	1
42	" "	Side wall	2 3/8 x 7 3/8" " " 1/2" "	2
43	" "	" "	9 3/8 x 17 3/8" " " 1/2" "	2
44	" "	" "	5 1/2 x 7 3/8" " " 1/2" "	2
45	H.R.S.	Block	1 3/8 x 9" " " 1 3/4" "	1
46	"	"	1" x 1 1/2" " " 1 3/4" "	1
47	"	Pad	1/2" x 1 1/2" x 3 1/2" lg.	1
48	"	"	1/2" x 2" x 6 1/2" lg.	1
49	"	Brace	3/8" x 4" x 6" lg.	2
50	"	Pad	1 1/2" diam. x 1/2" lg.	1
51	"	Boss	3" diam. x 1" lg.	4
52	"	"	3 1/2" diam. x 1 1/4" lg.	2
53	Nuts	Feet	1" x 1 1/2" x 8 3/4" lg.	4
54	——	End Wall	See swgr. SK. No. 27625	1
55	——	Base plate	" " " "	1
56	——	Brace	" " " "	1
57	——	"	" " " "	1
58	——	Support	" " " "	1
59	——	Brace	" " " "	2
60	——	"	" " " "	2
61	——	"	" " " "	1
62	——	"	" " " "	1

GENERAL INFORMATION	
Stamp tool No. on all loose parts	
Remove sharp corners where not needed	
Use scale for dimensions not in decimals	
▽ = Rough cut	▽▽ = Finish cut
P.F. = Press fit	F = Fit to other part
S.F. = Sliding or running fit	
All dimensions are in inches	

WELDING AND MACHINING SK
Anneal, shot blast and paint after welding
Weld full length unless otherwise specified
Total length (1/4) xx Fillet 117"
Total length (3/8) xxx Fillet 318"
Total length (1/2) xxxx Fillet 29"
Assembly SK Swgr. SK No. 1-A-983
Swgr. SK-1-A-984

Fig. 5—The jig body shown in this illustration was ready for machining in three days after the tool sketch had been furnished to the welding department. This time covered fabrication, annealing, shot blasting and painting. In addition to instructions to the welder, the drawing gives the total length of all the fillets

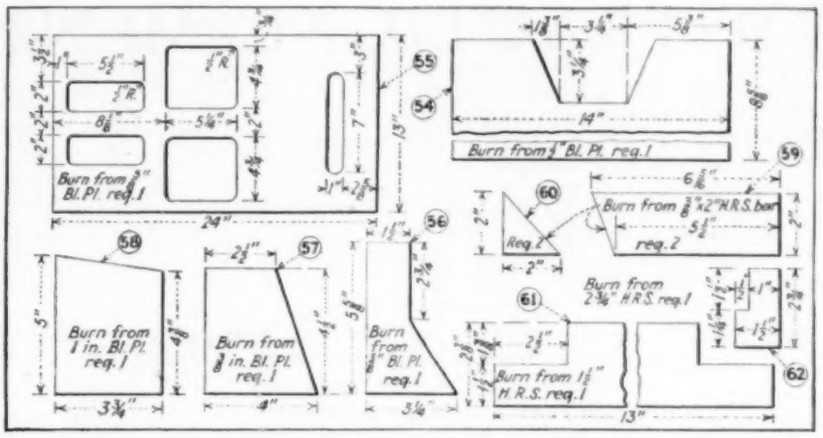
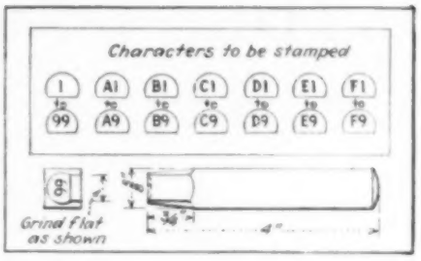

Burn from ⅜" Bl. Pl. req. 1
Burn from ¾" Bl. Pl. req. 1
Burn from ¾" Bl. Pl. req. 1
Burn from 1 in. Bl. Pl. req. 1
Burn from ⅜ in. Bl. Pl. req. 1
Burn from ¾" Bl. Pl. req. 1
Burn from 2¾" H.R.S. req. 1
Burn from 1½" H.R.S. req. 1
Burn from ⅜" x 2" H.R.S. bar
Req. 2
req. 2
24"
14"
13"

Fig. 6—Details of the jig body illustrated in Fig. 5. All the pieces to be cut out by burning are shown and the sizes of the bars from which they are to be made are noted on the drawing. This also contains instructions to cutters, welders and toolmakers. Fig. 7—Welders' identification stamps. Each welder is furnished with a steel stamp bearing a number. He is required to use his stamp on all work done by him. By this means, any welding that is not up to the standard for quality can readily be traced to the man who did the work



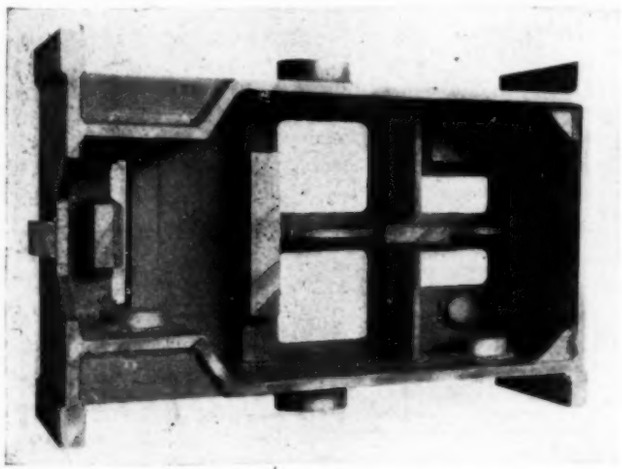


Fig. 8—Photograph of the finished jig body shown in detail in Figs. 5 and 6. This illustration shows that if the jig body were to be made of cast iron, quite an intricate pattern, including several loose pieces, would have to be made for the foundry

time-study information or from data that he has at his disposal. After a tool has been completed, it is weighed.

At one time it was customary to sell certain kinds of machinery by weight, based of course upon an observed, or estimated, cost per pound. With welded fixtures where machining is at a minimum, the weight, taken in conjunction with the length of weld, gives a fair idea of comparative costs.

Referring again to Fig. 4, the time-study man gets the depth of cut taken in burning from the thickness of the plate specified in the bill of material, and the length of the cut from the details of the parts. The welding time is computed from the total lengths of the fillets specified by the tool designer, and is given under the title at the lower right-hand corner of the sketch.

The 190-lb. jig body shown in Figs. 5 and 6 was ready for machining in three days after the tool sketch had been delivered to the welding department. This time covered all the cutting, welding, annealing, shot blasting and painting. As a check on the quality of the work done by different welders, each one is furnished with a stamp bearing his identification number, as shown in Fig. 7. He is required to use his stamp on all work done by him. Thus, any inferior job of welding can be traced to the man who did the work. The jig shown in detail in Figs. 5 and 6 is illustrated in its finished state in Fig. 8. The photograph shows it to be a remarkably clean piece of work.

Some Kinks in Jig and Fixture Design
Discussion

By L. O. Brown
Toolroom Foreman, Holcomb & Hoke Manufacturing Company

IN THE *American Machinist*, Vol. 70, p. 734, H. S. Hinchman says, "In dimensioning the drawing, every point should be located from a true center line. It has been observed that in many cases the designer will start at the center line and dimension one point from another, thereby, introducing the possibilities of accumulated errors. My experience in designing and making tools has taught me that dimensioning from the center line is not always right. It is far better to show the dimensions from one side and one end of the part or assembly.

It is true that the designer can work better from center lines while the job is still tacked to the drawing board. But the toolmaker has a much easier time when the measurements are given from points that are positively and permanently located, instead of from imaginary lines which are difficult to locate and still more difficult to measure from. The designer can erase any pencil lines caused from a mistake in measuring from the center line. But when the toolmaker makes a similar mistake while working from an invisible center line, he must either make changes in other parts to compensate, or scrap the part. When the dimensions are given from the outside edges of the jig or fixture he has a positive location for the starting point of all measurements, and in case of doubt, and for checking purposes, he can always go back to this location with the confidence that it will be in the same place as before, without having to do a lot of time-killing measuring and checking.

It pays to clean and snag castings thoroughly before they come to the machine department. Clean castings are much more agreeable to handle and machines are less likely to be damaged from sand or grit. Some shops find that it pays to paint all castings with a spray coat before machining.

IDEAS · FROM · PRACTICAL · MEN

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

A Split Die for Punching Holes

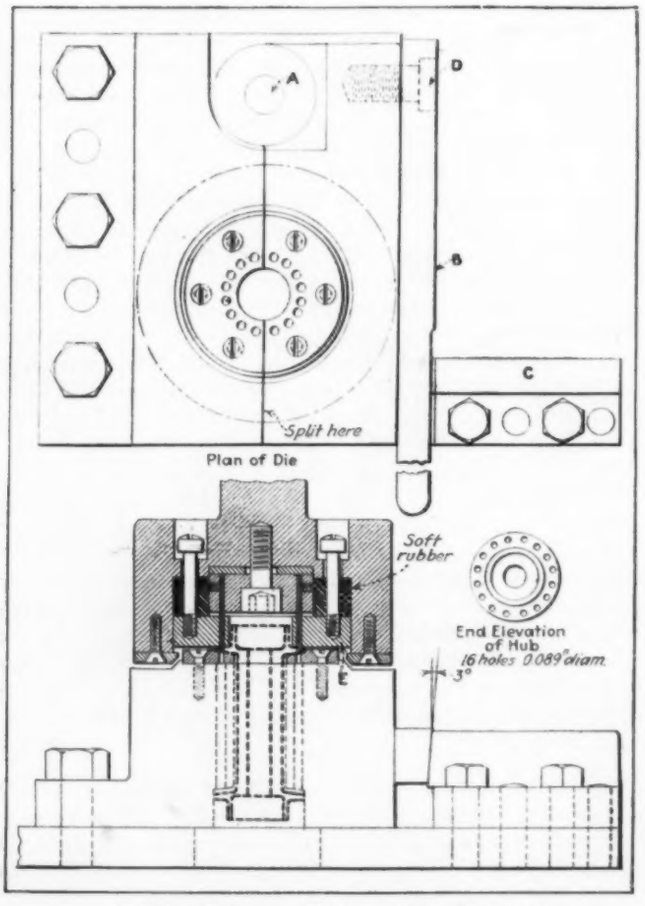
By Harry S. Taylor

The illustration shows a die used for punching 16 spoke holes in the end of a bicycle hub at one stroke of the press. The holes are 0.89 in. in diameter, and the material in the hub is screw stock. The flange that is punched is 0.07 in. thick.

The die is made in two halves and hinges on the pin *A*. The lever marked *B* swivels on pin *D* and when wedged against the block *C* it holds both parts of the die together. The important thing is to secure proper registration of the punch and die. The closure is not positive and a small chip between the two halves of the die would cause the punches to chip by striking against the sides of the holes. The inside bottom edge of the swinging part is beveled slightly to take care of this.

The stripper pad *E* is a sliding fit in the punch holder, and soft rubber is used for compression purposes.

We formerly drilled these holes on an Avey drill press and the best time we could make was 32 holes or one complete hub per minute. With this die an operator can punch both ends of five hubs in one minute. We use high-speed steel punches and buy the screw stock in bar lengths of the correct diameter.



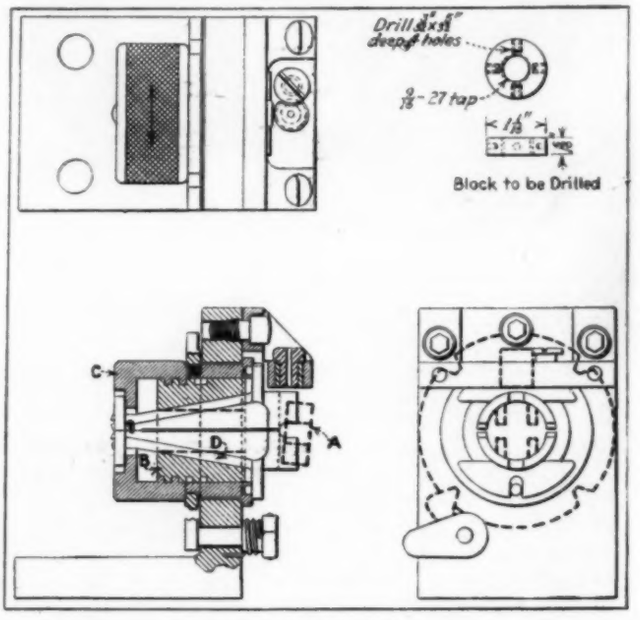
A split die for punching a circle of holes

An Indexing Drill Jig

By J. L. Levine

Department of Engineering, University of Michigan

This is the first year that a course in jig and fixture design has been offered at the University of Michigan, and it was begun because of the importance that production tools have attained in industry. The students in this class are given a thorough grounding in the fundamentals of this work through the medium of lectures and practical drafting-room problems of which the illustration is an example.



An indexing drill jig

At present, the class is engaged in tooling up a bench drill press designed by the students. The construction of this drill press is one of the practical features of the course in machine-shop practice.

The jig shown in the illustration is for the purpose of drilling small holes in one of the parts of the drill press, and is submitted because it has some features that may be of interest. The clamping jaws may be shaped to accommodate any size or shape of nut within reasonable limits.

The operation of the jig is simple. A single motion

will clamp or release the piece. Another simple motion permits rapid indexing. The parts are conveniently arranged. The nut is clamped between the two halves of a split jaw *A*, which may be opened or closed by the motion of a sliding collar *B*, having an internal taper to fit the external taper of the jaw. This collar is actuated by the rotation of the knurled nut.

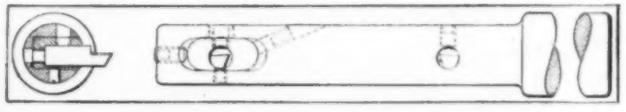
As the operator rotates the knurled nut *C* in a counter-clockwise direction—looking at the back of the jig—the internal left-hand square thread meshing with the sliding collar *B* draws the collar into the nut. Moving in this manner, the collar releases its grip on the split jaw and at the same time brings into action the two wedges *D*, which separate the jaws and permit removal of the piece. When a new piece has been inserted in the jaw, the operator gives the nut a twist in a clockwise direction, releasing the separating wedges and clamping the piece securely between the two halves of the split jaw.

By pressing downward on the lever *E* the operator withdraws the wedge-shaped tooth *H* from the indexing plate *J*, permitting easy rotation of the piece and clamping device as a unit. A torsion spring keeps the tooth and indexing plate locked during the drilling and loading operations.

Bar for Facing Both Ends of Bushings

By Hans Pokorny

The illustration shows a facing bar for use in a turret lathe, in which one of the tools is adjustable. The bar was designed for facing both ends of bronze bushings simultaneously. Besides doing the facing, the inner corners of the bushings can be rounded by grinding the tools accordingly. The bushings, of course, are held in



Facing bar for a turret lathe

a chuck, and their bores must be large enough to admit the bar.

A block, or holder, seated in an oblong slot in the bar holds the adjustable tool. The holder is confined in the slot by safety setscrews, and, being shorter than the slot, it can be moved endwise. A groove in the bottom in which the end of the lower screw engages, prevents the holder from falling out when the holding screws are loosened.

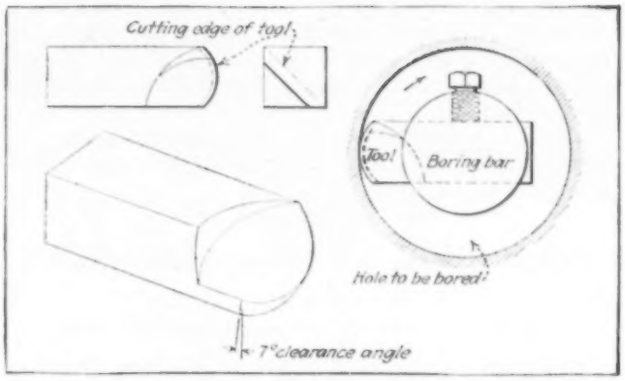
A Combination Boring and Reaming Tool

By Arthur E. Lynch

Demonstrator, Gisholt Machine Company

It is often necessary to bore an odd-sized hole for which no reamer is available. Usually this hole is small and deep, and the instructions call for it to have a smooth finish. The proportion of its diameter to depth is, in most cases, such as to prevent the use of a rigid boring bar. I have found the tool bit shown in the illustration, a means of finishing a hole smooth regardless of the flexibility of the holder.

It is shaped on the same principle as the shaving tool



A boring tool that gives a smooth finish

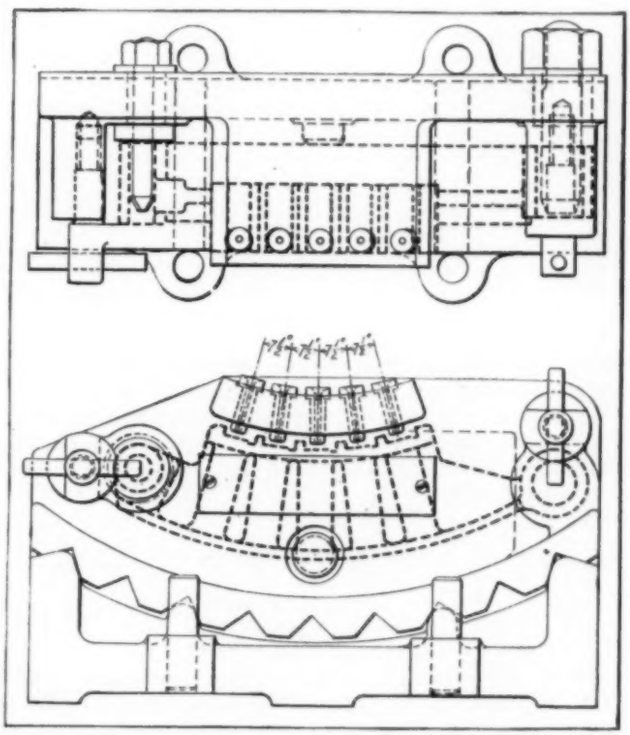
used in a shaper for finishing purposes, and on steel it cuts a somewhat similar spiral chip. It can be used in the turret of a screw machine and will, at times, save the use of a reamer.

An Unusual Indexing Jig

By A. Becker

The jig shown in the illustration is for drilling holes on radial lines in the sector represented by heavy dotted lines. Instead of the usual indexing pin, the rotating part of the jig has a series of angular notches cut on its under surface, so spaced as to match the rounded lugs in the jig base. As its weight and that of the work is sufficient to keep it in place, no pivot or locking device are required. The work is located by pins passing through holes in its ends and is clamped by two thumbscrews.

In operation, after one hole has been drilled, the rotating part of the jig is lifted so that the angular notches are free from the rounded lugs, and is rotated an amount



An indexing jig that has no index pin

approximately equal to the center distance between the notches. It is then lowered, engaging the notches and lugs, bringing the work in position for drilling the next hole. The operation is repeated until all five holes have been drilled.

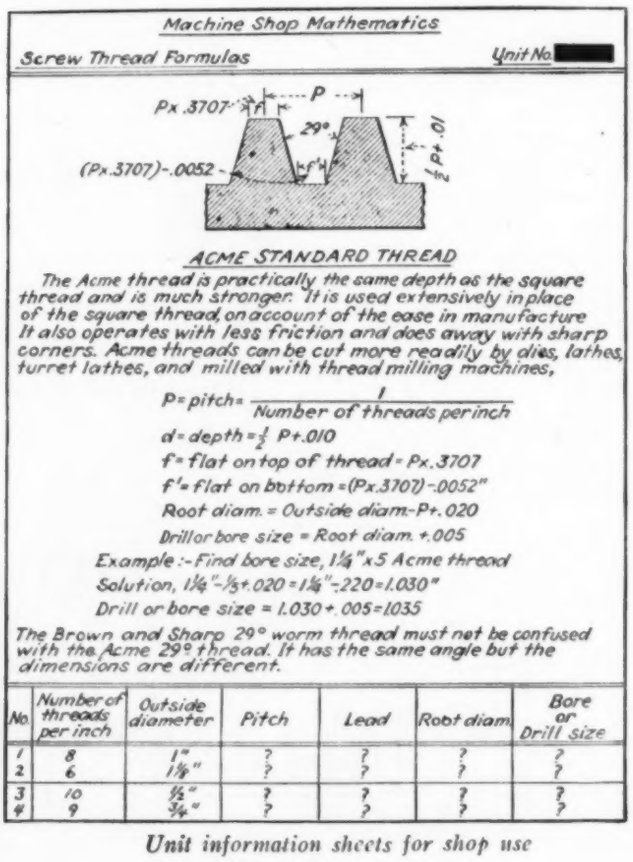
While a jig of this construction may not be the most accurate kind of a tool, it is cheap to make and the speed of operation is hard to beat.

Unit Sheets for Shop Mathematics

By Charles E. Dawson
Head, Machine Dept., Holyoke Vocational School

In my experience as a teacher of machine design and machine shop practice, I have found that the average book on shop mathematics is too confusing for the majority of the men who need and could use this kind of material.

As a means of clarifying and simplifying shop prob-


Machine Shop Mathematics
Screw Thread Formulas
Unit No.
Px.3707
P
29°
.01
(Px.3707)-.0052
ACME STANDARD THREAD
The Acme thread is practically the same depth as the square thread and is much stronger. It is used extensively in place of the square thread, on account of the ease in manufacture It also operates with less friction and does away with sharp corners. Acme threads can be cut more readily by dies, lathes, turret lathes, and milled with thread milling machines.
P=pitch= 1 / Number of threads per inch
d=depth=½ P+.010
f=flat on top of thread=Px.3707
f'=flat on bottom=(Px.3707)-.0052"
Root diam.=Outside diam-P+.020
Drill or bore size=Root diam.+.005
Example:-Find bore size, 1¼"x5 Acme thread
Solution, 1¼"-⅕+.020=1¼"-.220=1.030"
Drill or bore size=1.030+.005=1035
The Brown and Sharp 29° worm thread must not be confused with the Acme 29° thread. It has the same angle but the dimensions are different.

No.	Number of threads per inch	Outside diameter	Pitch	Lead	Root diam.	Bore or Drill size
1	8	1"	?	?	?	?
2	6	1⅛"	?	?	?	?
3	10	½"	?	?	?	?
4	9	¾"	?	?	?	?

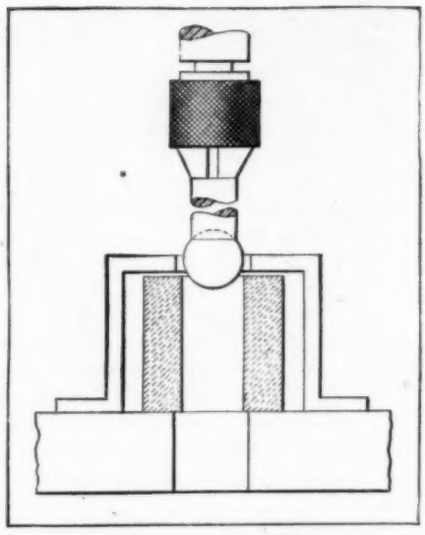
Unit information sheets for shop use

lems I devised the unit sheets, one of which is shown in the illustration. This sheet contains all that is necessary to solve the subject that it refers to and no more. They seem to have found favor with draftsmen and machinists in this locality as well as among our night school students.

Burnishing Holes in Aluminum
Discussion

By Charles Kugler

In an article under the title given above, on page 449, Vol. 70, of the *American Machinist*, Wm. S. Mahan describes a method of burnishing holes in aluminum by means of steel balls. While I have done considerable work of this kind, there has never been enough of it at any one time to warrant the making of such an expensive fixture as was illustrated in Mr. Mahan's article.



Simple method of burnishing a hole with a steel ball

In the method I have used, a ball is soldered to a shank, one end of which is cupped to fit the ball. The shank is held in a chuck in the spindle of a drill press and the work is slipped under a U-shaped bracket attached to the table of the machine, as shown in the illustration. By bringing down the spindle, the ball is forced through the hole in the work, giving it a highly-polished surface.

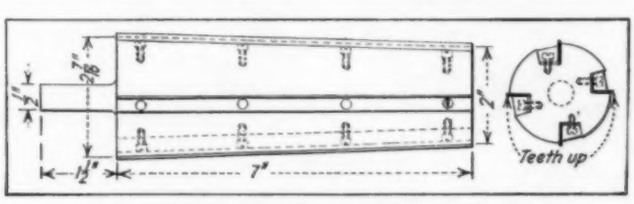
Upon the return of the spindle, the ball again goes through the hole, but this time in an upward direction. While the friction caused by the ball moving upward through the hole tends to lift the work from the table, the bracket holds it in place. The spindle of the drill press, of course, does not revolve during the operation.

Another Use for Hacksaw Blades

By Raymond H. Dauterich
Crescent Engineering Company

The illustration shows a taper reamer of peculiar design. The body is made of mild machine-steel and has four longitudinal grooves. Four hacksaw blades are fastened into the grooves by means of beveled clamps.

We were requested to make this reamer by a pattern-maker who wanted it for reaming taper holes in hard wood. Apparently there were several reasons why it would not be a success, and we were skeptical as to the



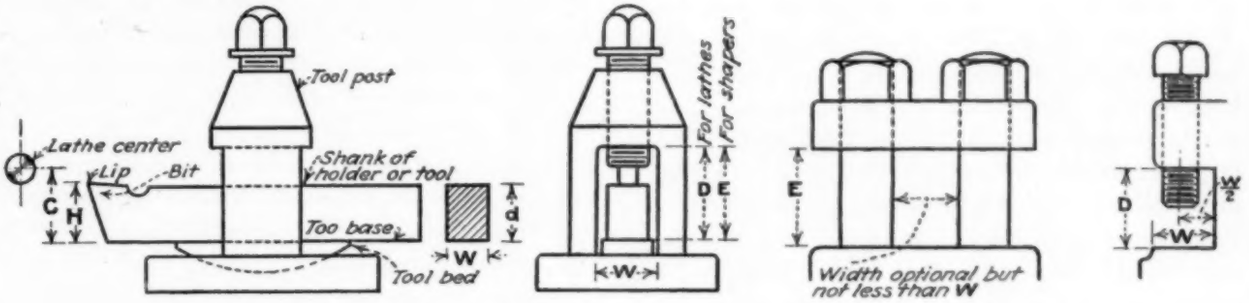
Reamers with cutters made from hacksaw blades

outcome. For instance, we thought the body was entirely too heavy for the shank, and that the driving capacity of the shank would not be equal to the demand upon it. Also, that there was danger of the saw blades becoming choked with chips.

Operated at a speed of about 200 r.p.m. in an ordinary drill press, the reamer made a smooth taper hole. Two of the saw blades are set with their teeth outward and projecting about $\frac{1}{6}$ in. from the body. The other two blades are set with their backs outward. Suitable clearance for the chips is made in the body, in front of each blade.

Toolholder Shanks and Toolpost Openings

American Standard



Types of toolholder shanks and toolpost openings conforming to the American standard

This standard for toolholder shanks and toolpost openings was developed by the Sectional Committee on the Standardization of Small Tools and Machine Tool Elements originally organized in September, 1922, under the procedure of the American Standards Association and sponsored by the National Machine Tool Builders' Association, Society of Automotive Engineers, and the American Society of Mechanical Engineers.

Studies of the various types of tools and tool holders were made by the Technical Committee on the Standardization of Toolholder Shanks and Toolpost Openings which correlated and combined the various dimensions into a single standard. This was submitted to industry for criticism and comment. The standard was favorably received, the formal approval of the Sectional Committee and the sponsor organizations followed in order, and the American Standards Association gave its approval and designation as American Standard.

With the approval of the various organizations mentioned behind these standards, there can be little doubt as to their adoption by manufacturers and users as rapidly as possible without discarding existing machines and parts. As in nearly all standardization, the greatest benefit is derived by the user who can then select such standard tools as fit his needs, knowing that they can be used interchangeably on the different machines in the plant. This standardization means a decrease in the inventory which also affects storage space and the attendants needed, as well as interest on the investment. These same advantages also benefit the jobber or dealer whose stock of tools can be considerably reduced. Manufacturers, however, will also benefit by being able to make toolposts in larger quantities or by purchasing them from those who specialize in the production of parts.

Dimensions of Tools and Toolposts Covered by the Standard

Tool Number	Shank Section			Lathe Opening			Planer and Shaper Opening			Lathe Center Height			Lip Height	
	Max.	Nominal	Max.	Min.	Nominal	Min.	Min.	Nominal	Min.	Max.	Nom.	Min.	Max.	Min.
	d	d×w	w	D	D×W	W	E	E×W	W	C	C	C	H	H
00	0.85	¾ × ⅜	0.40	1.27	1 ⅜ × ½	0.49	1.04	1 1/16 × ½	0.49	0.93	⅞	0.85	0.85	0.75
0	0.99	⅞ × 7/16	0.48	1.48	1 ½ × 9/16	0.57	1.19	1 ¼ × 9/16	0.57	1.09	1	0.99	0.99	0.87
1	1.15	1 × ½	0.56	1.72	1 ¾ × 11/16	0.68	1.38	1 7/16 × 11/16	0.68	1.26	1 3/16	1.15	1.15	1.00
2	1.34	1 ¼ × ⅝	0.67	2.00	2 × 13/16	0.81	1.61	1 ⅝ × 13/16	0.81	1.47	1 ⅜	1.34	1.34	1.25
3	1.56	1 ½ × ¾	0.80	2.34	2 ⅜ × 1	0.96	1.87	1 ⅞ × 1	0.96	1.72	1 9/16	1.56	1.56	1.50
4	1.81	1 ¾ × ⅞	0.95	2.71	2 ¾ × 1 3/16	1.14	2.17	2 3/16 × 1 3/16	1.14	1.99	1 13/16	1.81	1.81	1.75
5	2.11	2 × 1	1.13	3.16	3 ⅛ × 1 ⅜	1.35	2.53	2 9/16 × 1 ⅜	1.35	2.32	2 ⅛	2.11	2.11	2.00
6	2.43	2 ¼ × 1 ¼	1.34	3.65	3 11/16 × 1 ⅝	1.61	2.92	3 × 1 ⅝	1.61	2.67	2 7/16	2.43	2.43	2.25
7	2.86	2 ¾ × 1 ½	1.60	4.29	4 ¼ × 1 ⅞	1.91	3.43	3 7/16 × 1 ⅞	1.91	3.15	2 ⅞	2.86	2.86	2.75
8	3.34	3 × 1 ¾	1.90	5.00	5 × 2 ¼	2.27	4.00	4 × 2 ¼	2.27	3.67	3 ⅜	3.34	3.34	3.00
9	3.87	3 ½ × 2	2.26	5.80	5 ¾ × 2 ¾	2.70	4.64	4 ⅜ × 2 ¾	2.70	4.25	3 ⅞	3.87	3.87	3.50
10	4.50	4 ¼ × 2 ½	2.69	6.75	6 ¾ × 3 ¼	3.21	5.40	5 ½ × 3 ¼	3.21	4.96	4 ½	4.50	4.50	4.25
11	5.25	5 × 3	3.20	7.87	7 ⅞ × 3 ⅞	3.84	6.30	6 ⅜ × 3 ⅞	3.84	5.77	5 ¼	5.25	5.25	5.00

All dimensions in the table are in inches.

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

What Price Graduates?

IT MAY be true, as several learned men have recently stated, that a college education has no immediate sales value in the employment market, yet the offers that are being made to this year's graduates by the scouts from some of our large corporations hardly bear it out. Two hundred dollars a month to start is not uncommon, and there are reports of two hundred fifty and even more for the most promising men in a good class. Rather disconcerting news for those of us who started at sixty dollars a month, or less, but still only an indication that times have changed, that the business world is waking up to the fact that good men are not common and that it pays to gamble a little on the potential comers.

But this attitude on the part of the big fellows puts it right up to the employer who cannot afford scouts and is unaccustomed to such salary scales, to decide whether he will meet this price or be content with the second-rate men, or none at all. What has he to offer to offset the advantages held out by the big employer? Can he give the boy a better place in which to work, a better chance to learn many sides of a business or industry because of the relative smallness of his enterprise, or a better chance for advancement for the same reason?

If not, he had better consider his case carefully to see what he is going to do when he absolutely must have new blood in the business. Procrastination will only place him in the position of the company that waited until April to look over a college senior class, and found that there was but one man left who had not been signed up.

Getting Advice from Those Who Know

USERS of special machine equipment frequently waste time and money by failing to consult the builder as to the best method of solving troublesome problems. A case in point relates to a complicated part that was to be die-cast. The customer designed the part and asked for a quotation to include the production cost and the die cost. But the part was not properly designed from the die-casting point of view. The wall thickness was too uneven, the design called for several complicated cores and the limits were too close to be practical.

In spite of the fact that the defects in design were pointed out by the die-caster, the customer insisted on having the piece as originally designed —and he paid for it in hard cash. Production was slow and the rejections because of defects were very high. Even at this price the castings were less expensive, by reason of the elimination of several machining operations. Finally the customer listened to reason, and redesigned the piece. As a result production was increased while the cost per piece was reduced.

It is always a problem for manufacturers to determine how far it pays to offer engineering advice to customers. They naturally need orders to keep work going and it is much easier to quote prices on designs as presented than to point out ways in which they might be improved.

On the other hand, some contract shops have built up a desirable clientele by acting as consulting engineers as well as manufacturers. Customers rely on their judgment and do not insist on designs that are impossible from an economic viewpoint. This kind of engineering service should be paid for, either as a direct charge or as a part of the contract price, and paid for cheerfully, because it is a real saving to the customer.

Importance of Tool Grinding

WITH so many important details in connection with modern manufacturing to be mastered it is perhaps natural that some of them should not receive due attention. Tool grinding is one of these details whose importance is not always fully appreciated.

According to some who have studied the matter, the lack of proper tool grinding is responsible for much unnecessary expense for power, for tools, and for abnormal wear on machines. On belt-driven machines dull tools may easily add materially to belt expense. With the large motors usually supplied with machine tools, the dulling of cutting tools is not easily noted unless the power required is indicated on an ammeter.

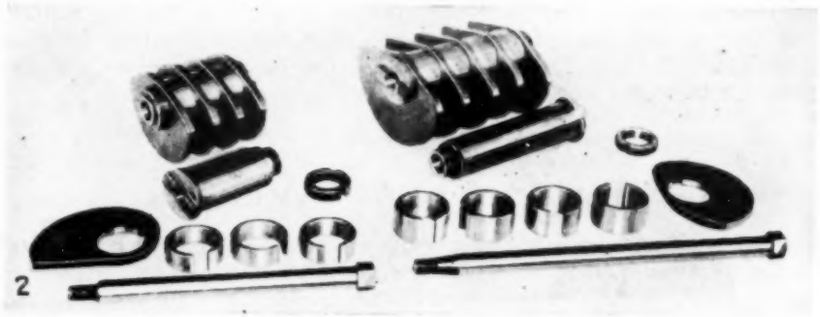
The ammeter, however, makes it easy to check the condition of the cutting tools and can frequently convince the most skeptical as to the economy of a centralized control of tool grinding. Even comparatively small shops will find it advantageous to consider standardized tool grinding methods, whether or not it is deemed advisable to adopt any particular standard of tool shapes.

Redesigned Davenport Model B Five-Spindle Automatic Screw Machine

ALTHOUGH based on the unit described on page 753, Vol. 63, of the *American Machinist*, a complete redesign of the model B five-spindle automatic screw machine has been announced by the Davenport Machine Tool Company, 167 Ames St., Rochester, N. Y. One of the new features is that the two sets of cams which feed and return the tool spindles and cross-slides are now assembled on sleeves as shown in Fig. 2, so that all of the cross-slide cams, or the tool-spindle cams, can be quickly inserted or removed as one unit. Two sets of sleeves are furnished so that when the machine is operated on jobbing work, cams to suit the next job can be assembled on sleeves ready for substitution on the machine as soon as the work being performed has been completed.

All cams for the cross-slides are now located at the front of the machine as shown in Fig. 1, where they are more convenient than in their former position at the back. Both camshafts run at one speed for one-half of each revolution and at another speed, for the remainder of each revolution. While the camshafts are turning at the faster speed, the tools are returned from the work, the workhead unit is unlocked, indexed and relocked, and the stock is fed into the chuck that has been indexed into the loading position. While the camshafts are rotating at the slower speed, the tools are fed to the work.

Two large wormwheels transmit the drive to the camshafts without backlash. The camshaft that actuates the tools of the toolhead is connected to its wormwheels through a clutch. This construction enables disengagement of the drive to the toolhead tools so that in setting up the machine the spindles can be held in the withdrawn position, while the cross-slide tools and the workhead are operated. The index wormshaft and the feed wormshaft run in Timken tapered roller bearings.



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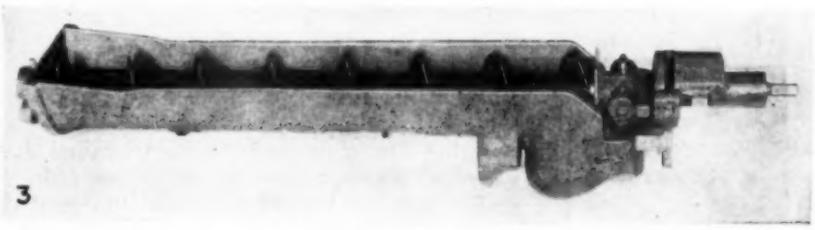

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Fig. 2—Showing how the cams that control the operation of the cross-slides and tool spindles are assembled into units. Fig. 3—Conveyor for carrying away the chips without attention from the operator

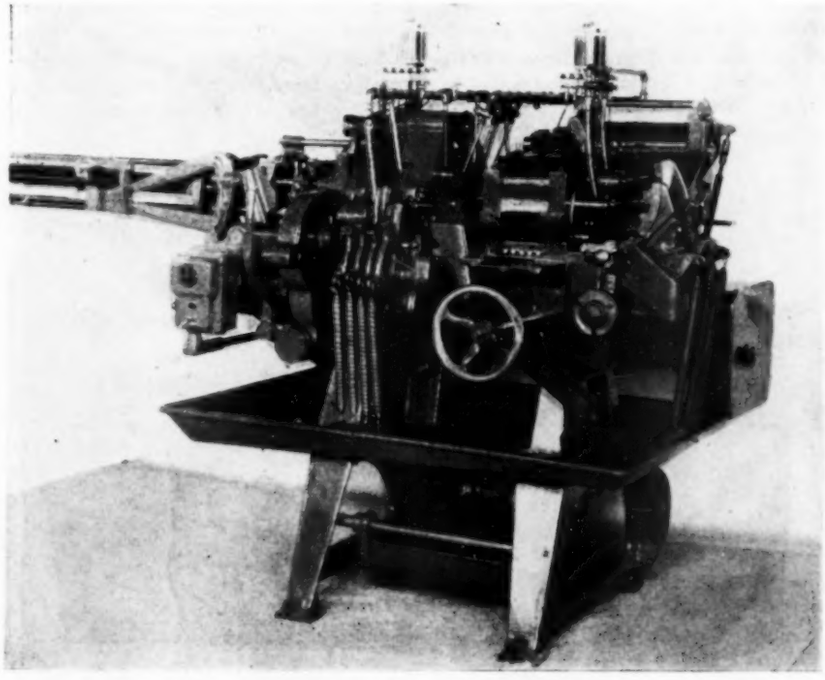


Fig. 1—Davenport Model B Five-Spindle Automatic Screw Machine which has recently been completely redesigned

The cam system to the cross-slide tools and the toolhead spindles is so arranged that the connections between the cam-operated levers and the spindles or slides are usually horizontal. When the connections are positioned at graduation No. 1 on the levers, the movement of the tools is the same as the movement of their respective cams. By adjusting the connection block upward, the amount of feed is increased, while by adjusting the block downward, the feed is decreased.

Other improvements in the machine include a threading clutch that can be employed in machining both brass and steel. Brass parts can be produced at rates up to 60 per min., which necessitates 120 engagements and disengage-

ments of the clutch per minute. At the left of workhead there is provided an outside support, which eliminates overhang and also supports the wire case carrier, which prevents the head wearing down into the bed. Indexing of the head is accomplished through a Geneva movement. Provision is made for quickly feeding the stock into the chucks. Up to 3 in. of stock may be fed at a time and the tools can turn up to 2¼ in. in length.

Renewable seats are now furnished in the bed for the cross-slides, which are of a longer design. The stops for the cross-slides are located on the slides and not on the toolposts, as formerly. Hardened and ground tool spindles are supplied.

A chip conveyor of the construction illustrated in Fig. 3 can be furnished to carry the chips to the right-hand end of the bed and there discharge them into a receptacle. This conveyor does away with the delays occurring on some high-production jobs where it is otherwise necessary to stop the machine in order to remove the chips. The oil drains from the chips into the pan of the machine while the chips are being carried away by the conveyor.

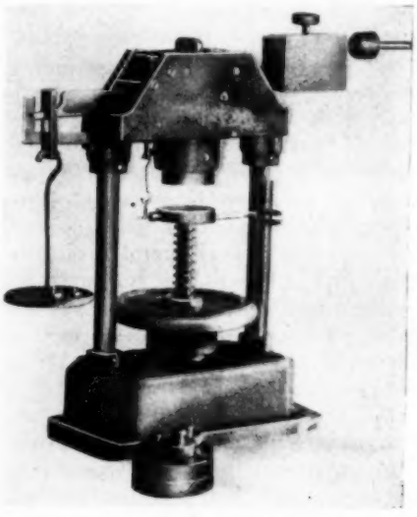
Acme "Hot Spot" Welders

SEVEN standard spot welders comprise the line of machines placed on the market by the Acme Electric Welder Company, Huntington Park, Los Angeles, Calif. These welders are available in sizes from 7½ to 100 kw., these capacities being based on the output at the electrode at the highest tap on a conveniently located heat regulator. Various intermediate types for special purposes can be obtained.

The transformers used on these welders are capable of 100 per cent overload of the rated capacity. In the larger sizes they are supplied with a cooling device, which tends to keep them cool under severe working conditions. Other features of the line are: The numerous malleable iron parts insuring against breakage from rough use; a hand-contact switch with easy thumb pressure make-and-break contact, thereby reducing arcing to a minimum, and lessening the strain on the operator's hand; an extra-heavy, toggle-type, 360-deg. bonnet swivel head, which gives great pressure with slight effort; a clamping device, which holds the lower swivel in any desired position, and which cannot mar the copper column, a half turn of the screw allowing free movement of the swivel either laterally or vertically, and extra-heavy construction of the secondary, horns, horn holders, column, electrodes and other copper conductors, in order to insure maximum electrical conductivity and reduce losses within the machine, between the transformer and the welding electrode.

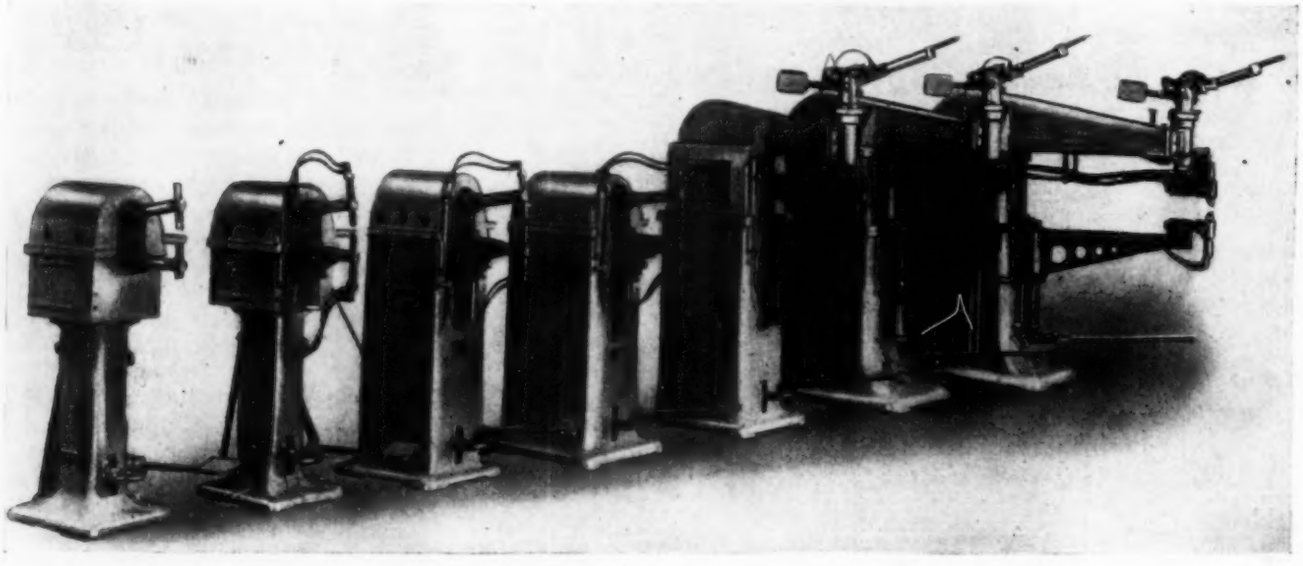
Coats No. R-25 "Elasticometer" Spring Tester

For the testing of small highly-sensitive springs with accuracy and under mass production methods at low cost, the Coats Machine Tool Company, Inc., 110 West 40th St., New York, has introduced an "Elasticometer" spring testing machine,



Coats No. R-25 "Elasticometer" Spring Tester

known as Type R-25, which can be used for tension and compression springs under loads from ½ oz. up to 56 lb. The weighing mechanism, located in the upper housing, has a 1 to 10 leverage. Drive is through a



Acme "Hot Spot" Welders arranged in order

screw spindle and handwheel located in the lower housing. The strength of a spring is determined by placing loose weights on the hook of the weight-beam. The scale attached to the right supporting pillar is graduated in $\frac{1}{32}$ in. and indicates length of spring, open, or compressed, or elongated. Tolerance markers arranged alongside of this scale facilitate quantity inspection.

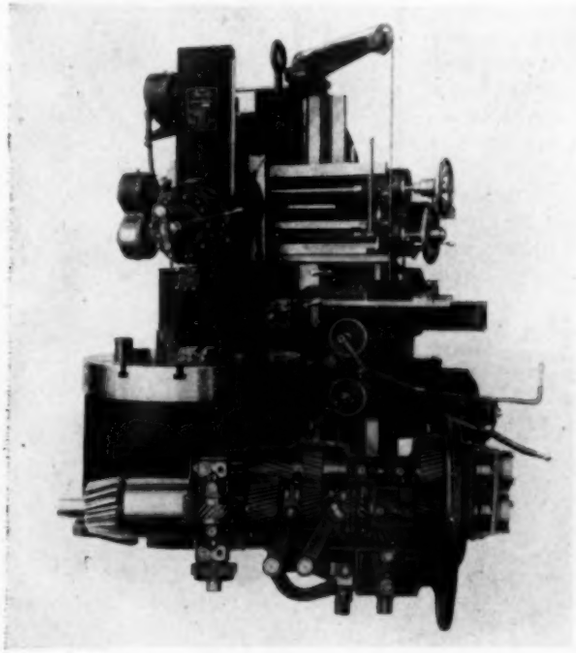
Centering or guide pins may be inserted in the lower compression plate for preventing small compression springs from buckling over. The upper compression plate is bored to permit the entrance of such guide pins. The tension hook for tension springs is located to the left of the upper compression plate. The slidable weight in the upper right-hand corner, together with its fine adjustment screw, is used for balancing the machine both before and after load is applied. Re-establishment of balance is indicated by the pointer located above the hook, which is suspended from the weight beam.

Other specifications of the machine are: Maximum distance between compression plates and tension hooks, 4 in.; maximum spring diameter, approximately $2\frac{1}{8}$ in.; space requirements, 16x17x6 in.; approximate net weight, 45 lb.; standard accessories, one set of pound weights up to 56 lb., and one centering pin for small compression springs.

Bullard Improved Vertical Turret Lathes

BULLARD vertical turret lathes of the "Spiral Drive" type, through a recent series of improvements, have been modified to increase their capacity and ability to operate beyond the demands of the latest cutting materials, according to the announcement of the Bullard Company, Bridgeport, Conn. Spindle speeds have been increased in the manufacturer's specifications and the recommended horsepower for motor drive has been selectively raised with adequate strengthening in construction on the various models from 25 to 40 per cent above previous ratings. This is the result of research into the requirements of the work encountered and the determination of a method for properly employing the higher-speed cutting metals, such as tungsten carbide.

The nature of faceplate work and the various diameters to be encountered determine the operations at higher peripheral speeds that justify the use of such cutting tools, whereas the smaller diameters machined necessarily at the lower peripheral speeds would not, under simultaneous operation, require more than the regular type of high-speed tools. A revision of design in the drive unit has been made. The secondary speed change case, as shown in the illustration, is now designed with a complete train of balanced spiral and helical gearing controlled in thrust and providing a smooth cutting action. This secondary case combined with the standard primary one provides variously eight and twelve different rates of speed through the respective sizes of machines in which it is applied. The table speeds obtainable through this unit, though varying with each size of machine, offers reasonable minimum diameters of work at which tungsten carbide and similar materials can be employed under maximum efficiency of operation.



Bullard Improved 42-Inch Vertical Turret Lathe and an interior view of the speed change case

"Electrair" Nos. 3 and 6, Electrically-Operated Mechanical Hammers

Two sizes of electro-mechanical hammers have recently been placed on the market by the Gifford-Brown Sales Company, Inc., 1 Broadway, New York, for the Electric Air Tool Corporation, of the same address. The hammers are suitable for chipping, chiseling, caulking, die-making, cleaning castings, wood-cutting, marble sculpturing and boring holes or channelling in concrete or stone.

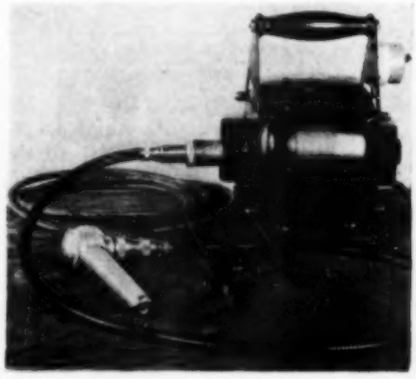


Fig. 1—"Electrair" No. 3 Electrically-Operated Mechanical Hammer

As the illustrations show, each outfit consists of a portable driving motor, a flexible shaft, and the hammer itself. A single-throw crank transforms the rotary motion of the shaft to a reciprocating one for imparting the hammer blow, and an ingenious air cushion is used to prevent a metal to metal contact between the work and the moving members. This air cushion is obtained by a plunger, carried on a universal joint at the end of the crank, that engages a bored hole in what might be termed the crosshead rod, and traps a small quantity of air in the bore. The other end of this crosshead rod bears against a coil spring when idling and against the tool end when work is

being done. With this construction, no blow is struck until the tool is pressed against the work and the force of the blow is determined by the extent of that pressure up until the maximum pressure is reached.

By separating the tool from the motor by a flexible shaft, lightness is obtained, and at the same time the motor is saved from excessive pounding. The tool body itself is made of aluminum with a steel nose for hold-

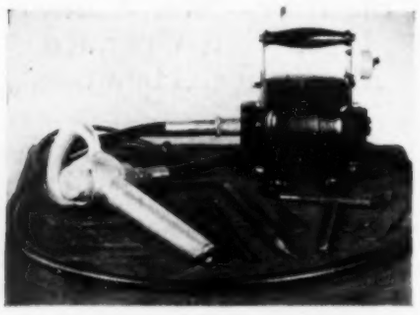


Fig. 2—"Electrair" No. 6 Mechanical Hammer shown with standard equipment

ing the tool and a bronze sleeve for the crosshead plunger bearing. Deep-groove ball bearings support the crankshaft on both sides, and in order to reduce the vibration from the reciprocating masses, the crankshaft is balanced with a lobe at each bearing support. Lubrication of the larger, No. 6 size, is by grease about once a week, and of the smaller, No. 3 size, by a light machine oil applied at intervals.

Either a.c. or d.c. driving motors are regularly furnished and rubber covered cable is supplied with plugs for attachment to any lighting socket. Handles are attached to the motor for convenience in carrying about. Fully-inclosed General Electric motors are regularly furnished. The No. 3 Electrair is driven by a 1/15-hp. motor operating at 3,500 r.p.m., and is supplied with a standard S. S. White flexible shaft 4 ft. long. The hammer itself weighs 1½ lb. A ½-in. cold chisel and a ⅜-in. star drill are standard equipment.

The No. 6 Electrair is driven by a ¼-hp. motor of the same frame size as for the No. 3 unit, and has 5 ft. of flexible shaft. The speed in this case is 1,750 r.p.m. The hammer weighs 5½ lb. In addition to a cold chisel, star drill, and chuck a spanner wrench, and drift key are furnished as standard equipment. There is also available a hand piece which may be substituted for the hammer and used for grinding and buffing. In either case, any length of flexible shaft up to 15 ft. can be obtained for both units. A tumbler switch mounted on the motor frame is used for control.

Lewis-Shepard Corrugated Pressed-Steel Skid Platforms

Corrugated pressed-steel skid platforms in a number of special and standard sizes as well as gages, have been announced by the Lewis-Shepard Company, 171 Walnut St., Watertown Station, Boston, Mass. Various removable-type stock boxes are also available for use on these platforms when transporting loose materials and small units. Where desired a stock box can be permanently attached to the skid platform by welding and for use without platforms the stock boxes can be equipped with corrugated bottoms. Interior tiering angles are riveted to the inside of the leg of the standard skid platform to facilitate storing and piling.

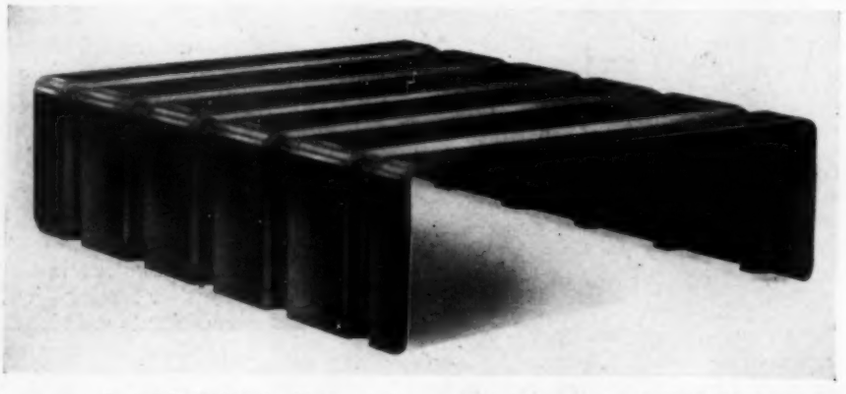
The skid platform is made of one piece of sheet steel formed under pressure. The ribs and corrugations are uniform throughout. The deep corrugations insure rigidity and act as supporting girders, which prevent the platform from sagging. They also give wider bearing surface on the floor. A rib and shoulder crimp keeps the legs from spreading and buckling. Special knee braces may be riveted to the legs at each corner and the under side of the deck to strengthen the platform against unusually heavy loads and strain. Steel lugs for holding the stock boxes and stake holders for holding the loose materials can be welded in the corrugations. Other types of reinforcement and special fittings can be applied for various kinds of service.

The corrugated pressed-steel skid platforms are made in 24- to 48-in. widths in increments of 6 in., and in 24- to 78-in. lengths in increments of 6 in. The heights are 6½, 7½, 9½, 10½, 11, and 12 in. Gages available are 7, 9, 10, 11 and 12. A shipping size, 33x54x12 in., is carried as standard. Corrugated pressed-steel stock boxes to fit the first four widths are available and all but the last length. They are made in 6-, 12-, 18-, 24-, and 30-in. depths from 12-gage material. A box to fit the 33x54-in. shipping platform is carried.

Starrett No. 666 Thickness Gage Stock

Thickness gage stock in rolls has been placed on the market by the L. F. Starrett Company, Athol, Mass. Since it comes in rolls, it is handy for production operations, where certain thicknesses are in constant use. The No. 666 stock comes in 25 ft. rolls ⅛ in. wide, and in thicknesses from 0.0015 to 0.015 in., packed in a

Starrett No. 666 Thickness Gage Stock which is supplied in rolls. A holder is shown at the left



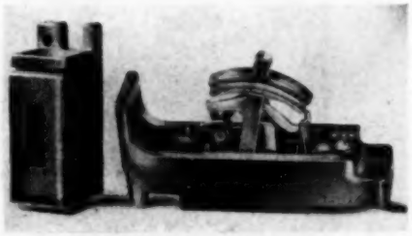
A standard Lewis-Shepard Corrugated Pressed-Steel Skid Platform

metal case. The stock is spring tempered to insure accuracy and dependability, and is marked every 6 in. with a line and the thickness, which permit cutting and eliminates waste. It is used in a No. 806 thickness holder, shown at the left-hand side of the accompanying illustration. This holder will take any thickness from 0.0015 to 0.025 in., and by its use prevents abrasions to the hands of the operator. It is of convenient size to carry in the pocket.

Westinghouse 15-Ampere Circuit Breaker

A 15-amp. breaker based on the "Deion" principle has been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. When an abnormal overload occurs on a branch circuit, the breaker open automatically and can be immediately reclosed provided the overload condition is not sustained. Since the automatic mechanism trips free of the handle, the contacts cannot be held closed against an abnormal overload or short circuit.

The circuit breaker consists of a sturdy toggle mechanism actuating



Westinghouse 15-Ampere Circuit Breaker

the moving contacts and insuring full contact pressure up to the time of opening. The automatic release is secured through a bimetallic thermal element engaging the releasing latch of the mechanism.

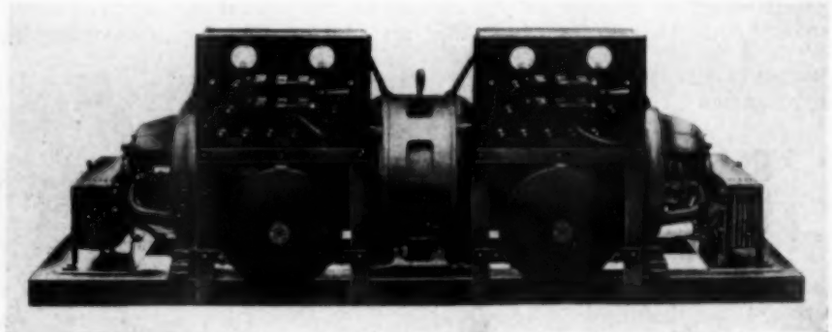
The high rupturing ability of the automatic circuit breaker is secured through the Deion principle. The moving contact in opening passes through a slot in a series of metallic plates insulated from one another, so that the arc is drawn through a relatively narrow passage and its heat is dissipated through absorption by the surrounding metal plates. Upon passing through the quencher plates the arc gases are expelled into an insulated expansion cavity in the base.

The circuit breaker will carry 10 per cent above normal load indefinitely without tripping, 50 per cent above normal for less than 2 min., and higher overloads only instantaneously. The circuit breaker is inclosed in an insulated sealed housing. This construction, combined with the trip-free handle, successfully prevents blocking the mechanism in the closed position, as well as insuring tripping at the normal and original setting. The housing is of cold-molded composition and consists of a base and cover. Space requirements are the same as for the conventional toggle switch and fuse.

"Dualarc" Two-Operator Welding Outfit

ELECTRICAL coupling of two generators in multiple to form an improved "Dualarc" two-operator welding outfit has been developed by the Electric Arc Cutting & Welding Company, 152 Jeliff Ave., Newark, N. J. This cross-connection is accomplished in such a manner that it is impossible for only one generator to take the load, thus permitting two operators to draw current to suit their needs. The coupling is effecting by sending the armature current of the first generator through the series field of the second unit, and sending the armature current of the second through the series field of the first machine. By this means the generators are caused to operate stably in multiple. Furthermore, the same arrangement will permit the generators to be put in series so as to secure higher voltages for cutting or carbon arc welding or for heavy bronze welding. By mechanically separating the two generators, it is possible to get independent control and adjustment and also but one-half power consumption at half demand.

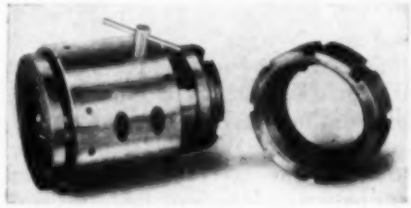
These machines are made in three sizes, namely 20 to 40 amp., 30 to 300 amp., and 40 to 400 amp. The ratings of the motors are 15, 20 and 25 hp., respectively. The apparatus can also be supplied in the gas-engine driven type, ratings of the gas engine being 20, 30, and 40 hp., respectively. The overall size in each case does not differ much from 5 ft. long, 3 ft. high, and 2 ft. wide.



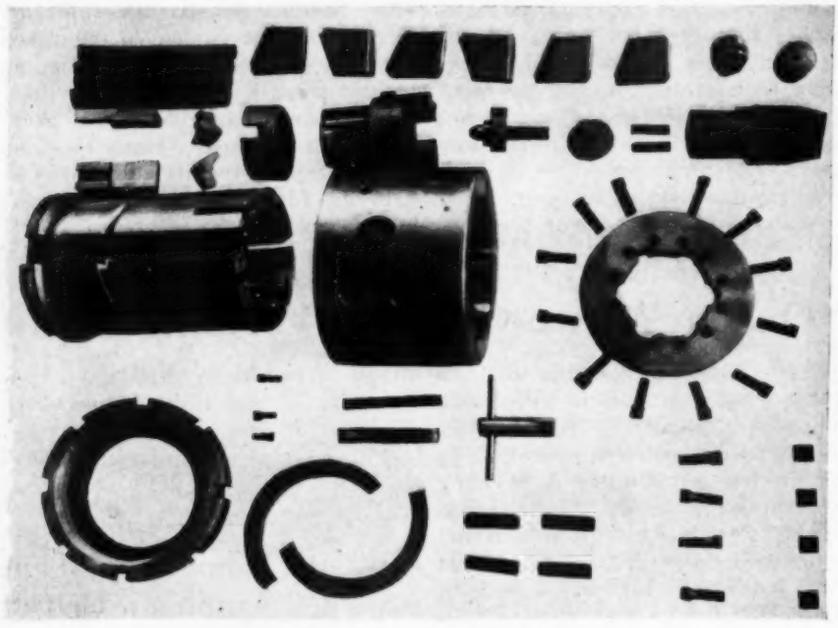
"Dualarc" Electrically-Coupled, Two-Operator Welding Outfit available in three sizes

Davis & Thompson Type "CC" Automatic Self-Opening Diehead

For use on the "Rotomatic" threading machine, an automatic self-opening diehead weighing 400 lb. and 18 in. in length has been developed by the Davis & Thompson Company, 57th Ave. & Mitchell St., Milwaukee, Wis. Six of these dieheads are used on each machine, which has a capacity for threading pipe from 2 to 4 in. in diam. The closing mechanism on the head is taken care of by the operation of the machine. Changing



Davis & Thompson Type "CC" Automatic Self-Opening Diehead



Parts for the Davis & Thompson Type "CC" Automatic Self-Opening Diehead

chasers is accomplished by the T-handle wrench shown in the die.

The graduated dial near the underside of the die is marked to show the position of the chasers and the adjusting screws are located immediately adjacent to each side of this dial. Adjustment is obtained by means of a wormwheel with an eccentric pin on one end to operate the mechanism in feeding. The diehead is arranged for an internal trip so that, when proper lengths of pipe are cut, the dies open automatically. Simplicity in construction is apparent from the few parts used.

Hutto Model MP Naval Gun Grinder

GUN barrels up to 61 ft. in length and 16 in. in bore can be ground in 6-ft. steps by means of the Model MP grinding machine built by the Hutto Engineering Company, Detroit, Mich. Work starts at the breech and as each 6 ft. is inspected and passed, a length of the universal, shown broken in the illustration, is removed. The work proceeds in this manner from breech to muzzle. The wet grinding process is employed, kerosene being the coolant. Grinding is done by means of a tandem unit equipped with 5-in. stones at either end. It is claimed that no error greater than 0.001 in. will be found. One test showed stock removal of 0.015 inch.

The model MP grinder is driven by means of a 7½-hp. motor. The machine has a 6-ft. stroke and electrical controls for the reciprocating knock-offs. It is supported by jacks under the control box after elevating and during grinding. According to the manufacturer, the equipment is applicable to any length within 61 ft., because lengths of the universal can be removed as desired.

Stow Flexible-Shaft Units

Various paint shop and metal finishing operations can be performed by means of the flexible-shaft units announced by the Stow Manufacturing Company, Inc., Binghamton, N. Y. The metal-working assemblies are suitable for die sinking, pattern work, grinding, polishing, and sanding, and many types of attachments may be obtained. The Model M-230 is equipped with a ¼-hp. motor and a 7-ft. flexible shaft, clamp spindle for wheels, brushes, buffs, No. 00 jiffy wheel with ten bands, a 6x1-in. grinding wheel, a 4x1-in. buffing wheel, a 4x1-in. scratch brush and a 1¼-in. chuck. The Model M-235 is

Stow Flexible-Shaft Unit equipped for metal-working operations. It is also applicable to paint-shop finishing jobs

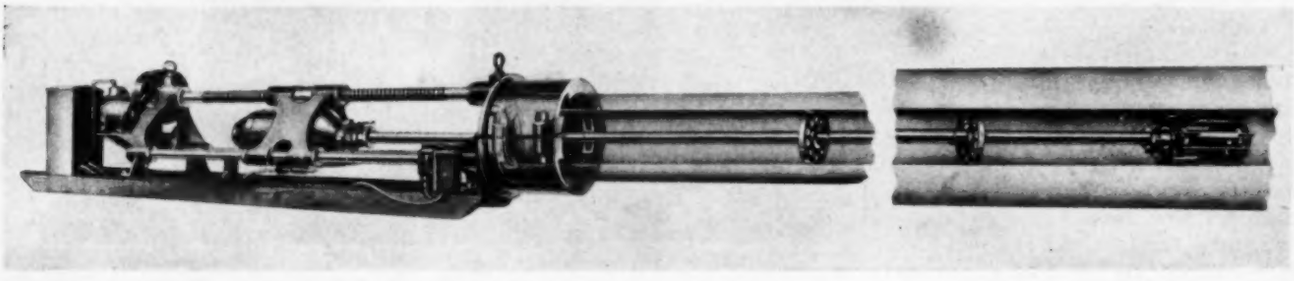


Diagram showing the Hutto Model MP Naval Gun Grinder for grinding 16-in. bores in 61-ft. gun barrels

equipped with a ½-hp. motor and several accessories. Hand-cut rotary files may be driven by means of this flexible-shaft unit, and they are obtained in many different sizes and types.

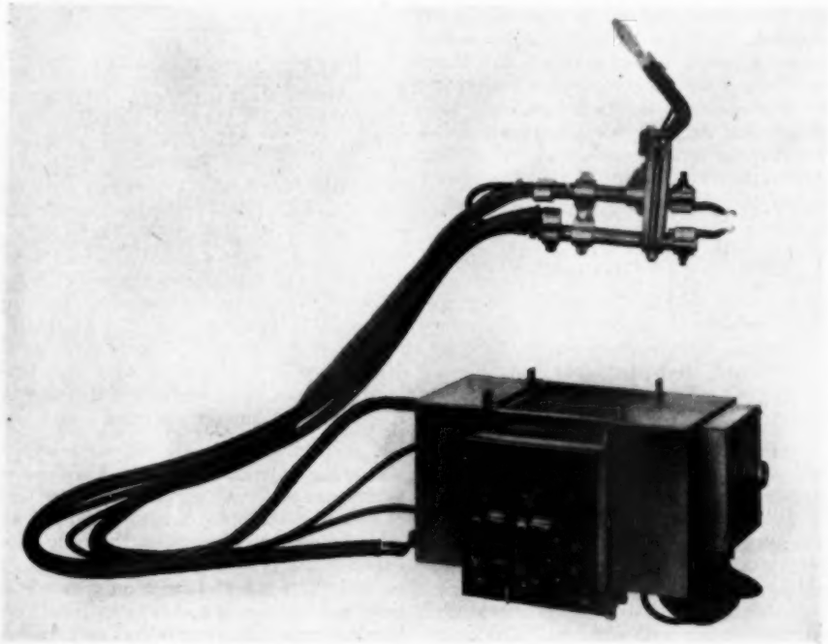
With regard to the paint shop units, Model L-180 is for refinishing purposes; and is equipped with a ¼-hp. motor, a 7-ft. shaft and angle head, 6-in. flexible-back polishing pad, and sheepskin. The Model L-185 has a ½-hp. motor, a No. 3 flexible shaft 7-ft. long, a large angle head, a 9-in. flexible back, a 7-in. polishing pad, and a sheepskin.

Thomson 25-Kilowatt Portable Spot Welder

DESIGNED for use in welding light sheet-metal parts which, because of their shape or over-all dimensions, require the use of a portable spot welder, the 25-kw. unit illustrated has been announced by the Thomson Electric Welding Company, Lynn, Mass. It is particularly useful in welding operations on window frames, door frames, and automobile body parts. The unit consists of a 25- or 35-kw. transformer on which is mounted a magnetic wall switch and also a five-point regulator switch, which is connected to the tapped primary coil of the transformer for obtaining variation in the welding voltage and current for different thicknesses of material. The welder is also provided with four ears to permit its being suspended from overhead if desired. Casters or small wheels may be fitted to the base in order to make the unit portable in the shop.

To the cast water-cooled terminals of the secondary, there are attached large extra-flexible cables, which terminate in a pair of hand-operated, water-cooled pliers. The design of these pliers is such that variously-shaped welding electrodes may be attached or removed quickly. Pressure on the welding points is obtained through a hand lever operating a rack and pinion. Pliers may be built with various throat depths. Control is through a push-button switch mounted on the plier lever and connected to the operating coil of the magnetic wall switch.

The transformer is designed to give high secondary or welding voltage, which is necessary when using a long length of flexible cable. Lengths of cable may be supplied up to 10 or 12 ft., according to the requirements.



Thomson 25-Kw. Portable Spot Welder for welding light sheet-metal parts of bulky size

Stephens-Adamson Type JFS Variable Speed Reducer

Improvement of the type JFS variable reducer transmission has been brought about by the use of ball bearing mountings throughout the entire machine. This unit is manufactured by the Stephens-Adamson Manufacturing Company, Aurora, Ill. All sizes and types have been equipped with ball bearings in each frame at

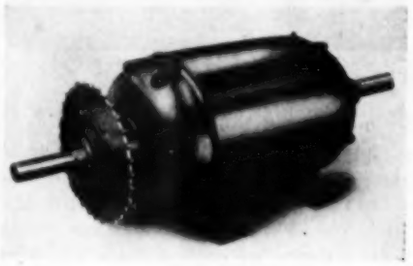


Fig. 1—Stephens-Adamson Type JFS Variable Speed Reducer arranged for chain drive

vital points as shown in Fig. 2. The ball bearings are accurately set and adequately lubricated. The internal circulation of the oil bath is ac-

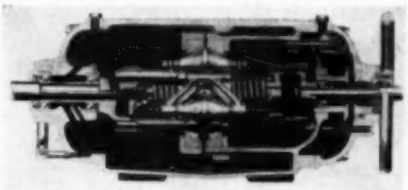


Fig. 2—Cross-sectional view showing the ball bearings used on the constant- and variable-speed shafts

complished by the splashing of the revolving parts.

Two ball bearings support the high-speed shaft and two others support the variable-speed shaft. The oil drain in each bearing cavity is arranged at sufficient height to insure a constant supply of lubricant at all times.

"Sprayit" Blow Torch

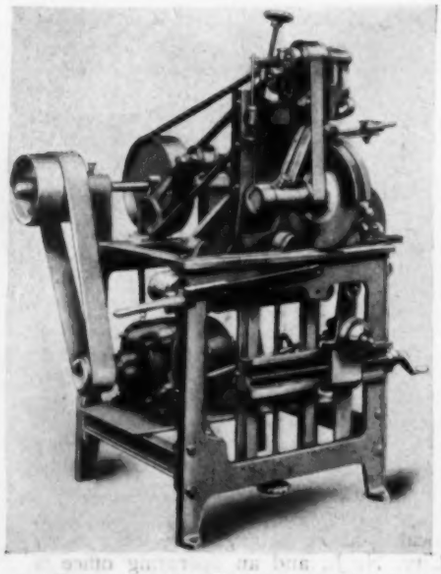
No pumping, priming, or preheating is necessary to operate the "Sprayit" blow torch announced by the Electric Sprayit Company, Inc., 320 East Colfax Ave., South Bend, Ind. A hot blue working flame is available instantly for the job at hand,

"Sprayit" Blow Torch

by simply turning the valve and applying a match. The torch is suitable for burning kerosene. Due to a complete pressure break-up of the fuel, correct combustion takes place with absence of carbon deposits. The torch is so designed that it may be attached to any air supply. It is interchangeable with the agitator type "Electric Sprayit Gun," manufactured by the company, on the compressor unit.

Foley Model G-111 Automatic Circular Saw Grinder

The Foley Saw Tool Company, Inc., Minneapolis, Minn., has placed on the market the Model G-111 automatic saw grinder for grinding and rejointing, in the same operation, all metal-cutting circular saws from 6 to 30 in. in diam., having either straight or Cochran-Bly teeth. All teeth having from ¼- to 2-in. spacing can be ground.



Foley Model G-111 Automatic Circular Saw Grinder

The grinder automatically brings high and low teeth to an even size and height as it grinds them to a cutting edge. The machine is durably constructed, and is inclosed so that filings, dust, and emery cannot work into the moving parts. Either belt drive or individual motor drive can be supplied. Interchangeable grinding wheels of different shapes, sizes and hardness are available for grinding all types of saws.

Trade Publications

CIRCUIT BREAKERS. The Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., has published bulletin 1,836, entitled "The New 'Deion' Circuit Breaker," which consists of a series of A.I.E.E. papers, together with magazine articles published recently covering the theory and development of the Deion circuit breaker and field tests which have been applied to it. The bulletin contains 49, 11x8½-in. pages well illustrated throughout.

LATHES, BENCH. The Rivett Lathe & Grinder Corporation, Brighton District of Boston, Mass., has published a pamphlet, Bulletin No. 505-C, on plain precision bench lathes, series 505. The bulletin contains a complete description and various uses of this machine, together with the specifications, and various types of attachments and tools. It contains twelve, 11x8½-in. pages.

METALLOGRAPHIC EQUIPMENT. The Bausch & Lomb Optical Co., 635 St. Paul St., Rochester, N. Y., has published a bulletin entitled "Bausch & Lomb Large Metallographic Equipment," which is devoted to explaining the use of such equipment for optical measurement and inspection in industrial plants. It is well illustrated and contains 31, 9x6-in. pages.

NITRALLOY. The Ludlum Steel Co., Watervliet, N. Y., has published a bulletin entitled "Nitralloy" and the Nitriding Process," which gives analyses of this material, physical properties, the operations prior to nitriding, equipment necessary for the process, the process itself, the operations after nitriding, and the properties of the nitrided case. Various examples of articles suitable for this process are shown. The bulletin contains 32, 11x8½-in. pages.

PHOTO-ELASTIC APPARATUS. Adam Hilger, Ltd., 24 Rochester Place, Camden Road, London, N. W. 1, has published a catalog entitled, "Professor Coker's Photo-Elastic Apparatus for Determining the Distribution of Stress and Strain in Structural and Machine Members." The catalog is a complete treatise on the construction, theory, and operation of the apparatus. It contains eleven 9x6-in. pages.

STARTERS. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has published leaflet 2408 on Class 13-100, non-reversing magnetic starter for wound-rotor induction motors. This starter features a new kind of contactor known as the "Deion." Specifications of the starter are given, together with wiring diagrams.

STEEL, ENDURO K.A. 2. This pamphlet by the Enduro Development Committee of the Central Alloy Steel Corporation, Massillon, Ohio, the Ludlum Steel Company, Watervliet, N. Y., the Babcock & Wilcox Tube Company, New York, N. Y., explains the various characteristics and uses of Enduro K.A. 2 stainless steel, an alloy of chromium, nickel, and iron. This material is stronger than carbon steel, is easily workable, can be drawn, spun, machined, and welded. The bulletin is finely illustrated and printed throughout, and contains specifications and various physical properties of this alloy.

STEEL. The Jessop Steel Co., Washington, Pa., has published General Catalog No. 4, entitled "Jessop's Steels," which lists steels for many different purposes, as well as carbon and high-speed tool steels and alloy tool steels. The catalog contains 112, 7x5-in. pages.

A.S.M.E. TENTATIVE STANDARDS. The American Society of Mechanical Engineers, 29 West 39th St., New York, N. Y., has published proposed revisions of the American Tentative Standards for cold finishing shafting (A.S.A.-B17a-1924) square and flat stock keys (A.S.A.-B17b-1925) plain taper stock keys (A.S.A.-B17d-1927), and gib head taper stock keys (A.S.A.-B17e-1928) as recommended by the Sectional Committee on the Standardization of Shafting. Copies are being distributed for criticism and comment on the part of the members of the society. Each pamphlet is printed on one 11x8½-in. sheet.

SCALE REPAIRING. The U. S. Department of Commerce, Bureau of Standards, Master Scale Depot, 5800 West 69th St., Clearing Station, Chicago, Ill., has published Bulletin No. 1 of the National Scale Men's Association, giving the specifications for overhauling and repairing of heavy capacity scales as approved and issued April 10, 1929. This specification consists of five 11x8½-in. pages.

News of the Week

Standard Sales Agreement for Gray Iron Castings

The Gray Iron Institute, Cleveland, has announced the formulation of a standard sales agreement and standard trade customs for the gray iron industry. In the standard sales agreement all quotations are made and all castings sold under the following terms: Quotations are to be accepted and patterns furnished within 30 days, unless otherwise specified. Castings are sold rough, f.o.b. cars, foundry point, terms 30 days net from invoice date, unless otherwise arranged. Claims for errors are to be made within 5 days from receipt of castings. The foundry is responsible only for foundry defects, and not for machine work, labor charges, and other losses, and complaints must be reported within 90 days. The foundry is not responsible for loss or damage to patterns by fire, or other causes, nor for failure to deliver because of strikes, accidents, and fires.

The trade customs provide for marking blueprints with rough weights, to form a definite basis for quotations where piece prices are concerned. Quotations are to include removal of gates, fins and other projections. Changes in orders after work is in process are at customers' expense. Cancellations are to be only by mutual consent. Unless otherwise stipulated, customers are to accept an overrun of 10 per cent. Special production service on rush orders is to be charged extra.

A.S.M.E. Prepares for Fiftieth Anniversary

Five days, April 5 to 9, 1930, will be given over to the fiftieth anniversary of the two gatherings, held respectively in February and April of 1880, that resulted in the formation of the American Society of Mechanical Engineers. The ceremonies next year will be international in scope and will record the achievements of the Society for the past fifty years, evaluate the influence of mechanical engineering upon the social and economic life of the country, and will point the way to future development.

The preliminary meeting of the Society on February 16, 1880 was held in the office of the *American Machinist*. The proceedings will therefore start in New York with a visit to the present office of the *American Machinist*, at 10th Ave. and 36th St., where appropriate ceremonies will be held. The organization meeting was held on April 7, 1880, in the auditorium of Stevens Institute of Technology at Hoboken, and on the second day of the celebration in 1930, the scene of this first meeting will be re-visited. Stevens Institute is preparing an elaborate pageant which will depict the early life of the Society. The final three days of the celebration will be held in Washington, D. C., with an interesting program of stimulating speakers from many other nations.

Invitations have been issued to the engineering societies and engineering schools throughout the world to send delegates to this event, which is expected to establish a new mark in engineering society development.

Tariff on Machinery Indicates Few Changes

As the tariff bill goes before the Senate Finance Committee, no drastic changes are forseen in the machinery paragraphs. Hearings before the four subcommittees began Wednesday June 12, and will be held daily through the ensuing month to give representatives of industry a last chance to plead for or against duty changes.

Comparatively few important changes were included in the machine sections of the tariff bill as it left the House. Although there were requests for increased protection on some thirty items in the hardware and tool group, increases were granted in only a few cases where foreign competition had become severe.

Timepieces are the notable exception, the watch and clock paragraphs having been entirely rewritten to suit modern conditions, and the rates increased about 50 per cent. Electrical machinery and equipment, and also catalyzing chambers, and the like, are assessed at 40 per cent to take them out of the 30 per cent clause for machinery not specially provided for. The basket clause naming parts of machines at 30 per cent ad valorem is restricted to parts whose value lies wholly or chiefly in metal.

Machine tools stand unchanged, but hand tools, including drills, planes, chisels, and other cutting tools; pipe tools, wrenches, screwdrivers; calipers, rules, and micrometers, are enumerated in a new paragraph at 50 per cent ad valorem.

Drills, reamers, taps, dies, cutting edges, and the like, more than 0.1 per cent vanadium or 0.2 per cent tungsten, molybdenum, or chromium, are at 60 per cent ad valorem. The alloy metals and ferro-alloys have been enumerated in detail, with few rate changes, except for tungsten, which is recommended for an increase from 45 to 50 cents per pound.

Pincers and pliers valued at less than $2 per dozen are up for an increase of 10 cents each, in addition to the present duty of 60 per cent ad valorem; over $2 per dozen, 20 cents each. This does not include slip-joint pliers.

Hollow bars and hollow drill steel valued at more than 4 cents per lb. are to pay 1.30c. per lb. in addition to the old rate. Woven-wire cloth receives a 5 per cent ad valorem increase. Other changes in machined items relate principally to small and highly manufactured articles, such as firearms, knives, and surgical instruments. Ball and roller bearings receive no readjustment.

Abrasive Makers Form Organization for Export

The Durex Abrasives Corporation has just been organized to cut exporting costs and improve mechanical sanding operations in a variety of industries throughout the world. The corporation includes nine companies in the abrasives field, who have individually withdrawn from the export field as far as their sandpaper products are concerned, and have combined under the Webb-Pomerene Act for the conduct of their export business. These companies are the American Glue Co., Armour & Co., Baeder-Adamson Co., H. H. Barton & Sons Co., Behr-Manning Corporation, The Carborundum Co., Minnesota Mining & Mfg. Co., United States Sandpaper Co., and the Wausau Abrasives Company.

The Durex Abrasives Corporation's activities will cover coated abrasive paper and cloth products for woodworking, metal working, shoe and leather manufacturing, electrical products, insulating materials, hat industry, paint and hardware trades and many other industries.

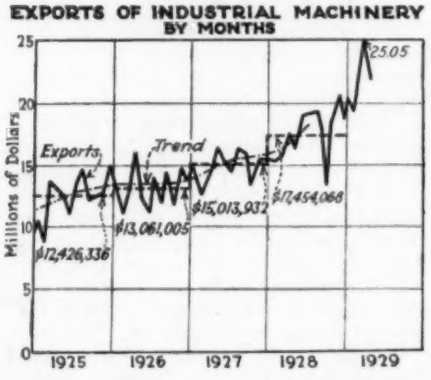
The officers of the Durex Abrasives Corporation are: A. J. Sidford (vice-president, Behr-Manning Corporation) president; F. J. Tone (president, the Carborundum Co.) vice-president; W. L. McKnight (vice-president, Minnesota Mining & Mfg. Co.) vice-president; D. W. Fernhout (formerly Gen. Mgr. International Behr-Manning Corporation) vice-president; R. W. Young (vice-president American Glue Co.) treasurer; L. K. Southard (formerly Secy. & Gen. Mgr. American Surface Abrasive Export Corporation) secretary.

A European Sales Division has been created in charge of D. W. Fernhout, vice-president, who will shortly establish headquarters in England. A second sales division covering the world outside Europe will be in charge of G. A. Bergstrom, formerly divisional sales manager of International Behr-Manning Corporation.

The corporation's head office is located at 70 Montgomery St., Jersey City, N. J., and an operating office is maintained at 82 Beaver St., New York.

Big Gain in Industrial Machinery Exports in First Four Months, 1929

EXPORTS of industrial machinery from the United States during the month of April, totaled $22,296,000, according to a report issued by the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce. This represented a decline of $2,754,696 under the record high level reached in March, but still exceeds the monthly average for any year since 1920, and is $6,129,000 over the volume attained in April, 1928. This decrease under March shipments has no particular significance, since the trade is subject to constant fluctuations from month to month, but of much greater importance



is the fact that exports of industrial machinery during the four months ended April, 1929, showed a gain of $23,693,000, or 37 per cent, over the corresponding period of the previous year, thus continuing the steady upward trend in foreign shipments.

A review of the details shows that this substantial increase during the first four months of 1929 is mostly based on sharp gains in exports of internal combustion engines, oil well and refinery machinery, mining and quarrying machinery, and power-driven metal working machinery. Of these the most striking increases appeared in the case of well and refinery machinery, exports of which almost doubled, and of internal combustion engines which registered a gain of nearly 60 per cent. With the single exception of water wheels and water turbines, however, increases were general all along the line.

In the metal-working machinery group, a few declines under the first four months of 1927 occurred for such items as thread cutting and automatic screw machinery, and radial drilling machines, but these decreases were overshadowed by the sharp increase in sales of the other items. Of the more important, for instance, shipments of lathes rose from $1,247,000 to $1,897,000; milling machines from $728,000 to nearly a million dollars; planers and shapers from $291,000 to $341,000; and internal grinding machines from $278,000 to $480,000, while deliveries of sheet and plate metal working machines, forging machinery, and foundry and molding equipment, were more than twice as large as similar shipments in the first four months of 1927.

Exports of such items of construction and conveying machinery as dredging machinery, concrete mixers, road grading and maintenance equipment, cranes, hoists and derricks and elevators showed outstanding increases over the first four months of 1928, although there was a slight falling off in deliveries of excavator parts and accessories, and road rollers. Shipments of excavators and power shovels far exceeded other items in volume.

Among the various classes of power generating machinery, exports of mechanically driven turbines, gasoline locomotives and other stationary and portable internal combustion engines, except Diesel and semi-Diesel, more than doubled, and there were also notable increases in shipments of Diesel and semi-Diesel engines, steam boilers, and condensers, heaters, and accessories.

The sharp growth of the demand for American mining machinery was evidenced by a general rise in all items except coal cutters. Shipments of mine hoists and derricks more than tripled and sales of ore-crushing and sorting machinery totaled $1,233,000 as against $904,000 in 1928.

Exports of centrifugal pumps nearly tripled last year's mark, and those of reciprocating steam pumps more than doubled. Foreign deliveries of rotary pumps, while much smaller in volume than the other items, were nearly seven times greater than in the first four months of 1928.

Foreign sales of tobacco and woodworking machinery, blowers and ventilating machinery, ball and roller bearings and parts, and air compressors, greatly exceeded those made from January to April inclusive of 1928, and in the case of refrigerating apparatus and laundry machinery and equipment were more than double last year's volume.

For some of the other principal items, however, business was not so good, and exports of bakery machinery and parts, ice making equipment, oil mill machinery, water meters, and particularly sugar mill and paper and pulp mill machinery, all substantially decreased under the first four months of 1928.

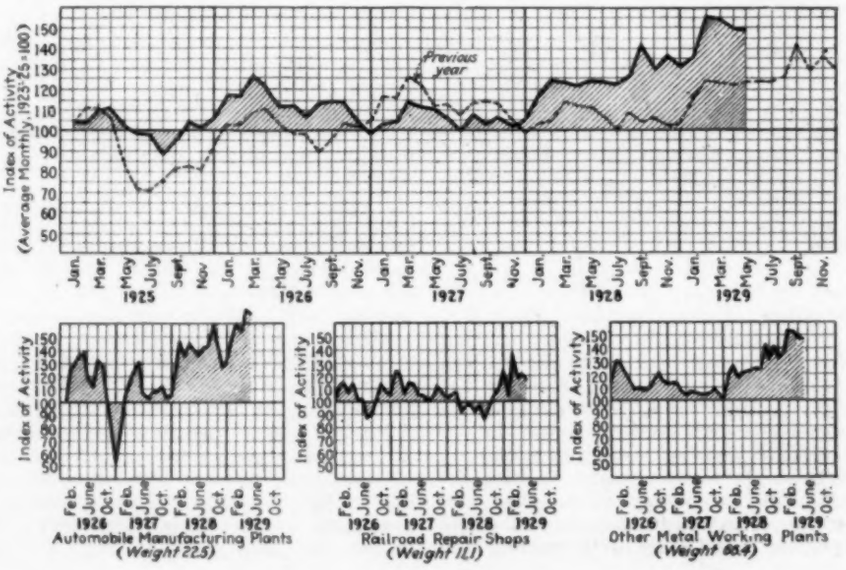
Production Continues High During May

THE first five months of the current year have been marked by the highest rate of productive activity in the history of the metal-working industry, based on the consumption of electrical energy in such plants. The average rate of activity in these plants during this period has been 18 per cent over that during the same period last year. The peak of operations was reached in February. There has since been a slight downward tendency, but of less than normal proportions. The metal-working industry is holding up very much better than in former years.

Incomplete returns indicate that during the month of May there was a slight drop of 1.1 per cent in the rate of operations for the industry as a whole. The rate during May, however, was still 19.5 per cent over the rate recorded in May of last year.

Automobile plants have been reporting new records in activity, month by month, but the May reports available indicate that the peak of activity was reached in April. A drop of about 2.1 per cent in activity occurred during May. Some of the larger automobile producers, such as Ford, however, reported material increases in car production during May, as compared with April.

Metal-working plants as a whole appear to have continued their slow decline which started in March. The monthly



decrease, however, has been materially less than would normally be expected at this season of the year. May operations in these plants were about 0.7 per cent under April, but were 16.7 per cent over May of last year.

Activity in the railroad repair shops during May, while slightly below April, was on a plane about 21 per cent over May of last year, a reflection of the continued high rate of railroad activity.

Mexican Market for Woodworking Machinery Improves

According to a report issued by R. C. Matthews, assistant chief, Industrial Machinery Division, Bureau of Foreign and Domestic Commerce, there are indications that conditions in the woodworking industry in Mexico will be much more favorable within the next three or four years and should offer a good market for the sale of American woodworking machinery. American exports of this type of machinery are at present well over $100,000 yearly and are exhibiting a tendency to recover after a decline in 1926, and especially in 1927.

Investigators have found that around Mexico City possibly at least 50 per cent of the machinery is of American manufacture, the remainder being fairly equally divided between German and French equipment. Up to the present, production has not been an important factor in the Mexican woodworking industry, and the equipment of practically all the plants on the average is now at least 8 to 12 years old. Now there appears to be some change in manufacturing policies, and the woodworking industry in Mexico is beginning to realize that in order to compete and cut costs it will be necessary to obtain higher production, and hence to buy better production equipment.

Probably one of the main factors holding up the sale of modern American machinery and equipment in Mexico is the decided lack of skilled labor. Another important factor is that very little attention seems to be paid to the maintenance of the machinery in proper condition. Furthermore, most of the shops are not laid out in manner to obtain the best manufacturing results, and in hardly any of them are conveyors or material handling equipment used.

Airplane Exports Double in Last Quarter

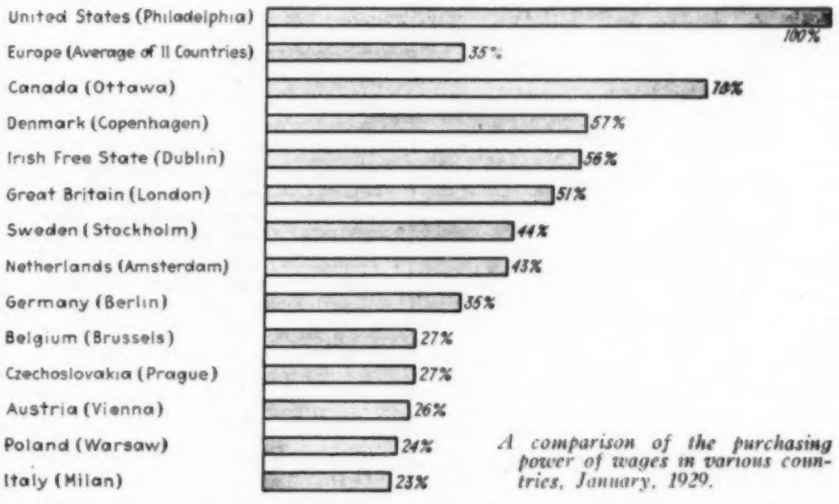
Exports of American-built airplanes doubled in value during the first quarter of 1929 as compared with the same quarter of 1928, the total for the first three months of the year being $1,103,520 according to an announcement by C. D. Rea of the Aeronautics Section of the Bureau of Foreign and Domestic Commerce in Washington. Sixty-nine airplanes, seaplanes and amphibians were sold abroad during the quarter as compared to a total of forty during the first quarter of 1928. Mexico, probably because of the revolution there, led all other nations during the quarter in the purchase of planes from the United States. Exports to Chile, second largest market, comprise both commercial and military planes. Canada was the largest market for airplane parts, with a total value of $322,091 this quarter. Germany and Japan took 55 of the 97 airplanes exported during the quarter.

The report indicates that the American aeronautics industry has awakened to the possibilities existing for sales in foreign markets.

U. S. Worker Has Large Purchasing Power

The average workers in the United States can purchase with their weekly wages, almost three times as much in the way of comfort in food and housing accommodations as is available to the workers of Europe. In the accompanying chart is shown how far the wages received by the workers of various countries will go toward purchasing the same quantities of daily necessities, in their respective countries, as can be purchased by the workers in the United States. The comparison is thus one of goods and service (rent) into which no factor of money, or exchange rate, enters. The chart shows that Canada more closely approaches the United States in its standard of living for the wage earners than any other country. As regards Europe, workers in the British Isles, Scandinavia and the Netherlands are more favorably situated than those of other European countries, as has been the case in recent years.

The figures were calculated and the data collected by the International Labor Office, at Geneva, and are supplied through the courtesy of the National Industrial Conference Board, Inc., New York. The indexes used are the ratios between the quantities of food that can be purchased with the wages of workers, after allowing for rent, compared with the amount purchasable here.



A comparison of the purchasing power of wages in various countries, January, 1929.

To Build Austin Car in America

The American Austin Motor Co., Inc., has purchased from the Standard Steel Car Co. a part of the latter's plant at Butler, Pa., and will use it for the manufacture of the English Austin automobile in this country. H. H. Stockfeld controls the American rights for the Austin car. The price paid for the property acquired in Butler, consisting of about 14 acres, is approximately $700,000. Final investment, it is said, however, will represent several million dollars. The car to be manufactured in this country will sell for about $450, and deliveries will commence about the first of 1930. The Butler plant will have a production capacity of about 50,000 cars a year.

Wheel Company Formed in Columbus

The Ohio Motor Wheel Parts Corporation, a $600,000 enterprise, now located in the Outlook Bldg., Columbus, Ohio, is preparing to get into production about September 1. A plant has been tentatively selected which will give the company about 75,000 sq.ft. of working space, and seven or eight acres of ground will be acquired adjoining the plant for expansion purposes. It is expected that the new company will employ about 1,000 men when it gets into full production. The company owns patents and machinery for producing wire wheels and spokes, and nipples, hubs, parts and accessories. Officers of the company are: James J. Sexton, president; O. E. Davis, first vice-president; C. G. Geyer, second vice-president and general manager; Franklin Rubrecht, secretary and general counsel; C. O. Howard, general superintendent and engineer in charge of wheel division; W. W. Stoler, engineer in charge of spoke and nipples division. A gross volume of business in excess of $2,000,000 is scheduled for the first year.

BUSINESS BAROMETER . . . *The drop in value of our farm products has exercised a repressive effect upon business, and a moderate recession is in view*

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

IT IS difficult to determine the relative importance of last week's happenings in the politico-economic field, but many of them are highly significant. To the internationalists the most striking and satisfactory incident of the week is the settlement of the reparations question that Germany has agreed to after so many months of discussion. The payments that are to be made, and the obligations that have been assumed embrace two generations, and while those who look back upon the world's history for the last sixty years may be pardoned for doubting whether the payments agreed upon will be made thirty or forty years hence, it is undeniable that the questions at issue have been put to sleep at least for the present, and that we shall have what may be called a period of international quietude for the next ten years. The work of the Reparations Conference may, therefore, be regarded as a constructive influence.

But against this there is to be put the sensational drop in grain that has recently occurred, and the lack of assurance, despite the recovery that has followed the agreement between the House and Senate conferees on the farm relief bill, that the pressure of the crop movement, which begins next month, can be absorbed without a renewed decline.

Very few realize what a difference the lower wheat prices will make in the purchasing power of agriculture. Wheat has recently sold at 93 cents in Chicago, the lowest figure reached in fifteen years. It represents a price of not more than 75 to 78 cents a bushel to the American farmer, and is at least 20 to 25 cents less than he received for his wheat a year ago. Upon a crop of 900,000,000 bushels that is a difference of $180,000,000 to $225,000,000.

Meanwhile it is undeniable that the drop in the value of our agricultural products has exercised a repressive effect upon business, and that a moderate recession in trade is to be expected. The stock market evidences this expectation and its tendency has been toward a lower price level, despite the bullish propaganda that emanated from those who have been carrying securities on margin.

The industrial news also is beginning to tell of slight recession, although in most lines activity is much greater than it was a year ago and momentum will keep production high for some time to come.

But the output of automobiles during May was 6 per cent less than in April, and it is admitted that the downward trend will be more marked this month. In building, too, the promise of improvement which April figures held out was not performed during May, for which the preliminary figures indicate a construction total much behind 1928. In time the falling off in these industries and the curtailment which farm implement manufacturers will probably put into effect will compel a reduction in iron and steel output, although the latter is still at the limit of capacity, and at least another month of full-time operation is expected.

In the money markets a significant reversal of the trend has occurred. Two weeks ago those who have been denouncing the Federal Reserve Board for its refusal to approve higher rediscount rates made a renewed drive upon it with the backing of the Federal Advisory Council's recommendation in favor of an advance.

For a few days Wall Street thought that the advocates of a 6 per cent rate would prevail, and it is probable that a change of one vote within the Reserve Board would have brought dearer money. But the wind changed unexpectedly and the board decided to cling to its policy of talking the market to death. In that it has had such success that two consecutive reductions in brokers' loans have brought them to the lowest figure this year and more than half a billion dollars below the high reached on March 20.

Whether this reduction has been caused by the threats of the Reserve authorities or by the logic of circumstances as displayed in the commodity markets and in the likelihood of industrial recession is not so important. The point is that the board evidently considers it "satisfactory," especially as it has been accompanied by severe declines in stock prices, a steady increase in the country's gold holdings and a reduction in the amount of Federal Reserve credit outstanding. Therefore the present Wall Street assumption is that no further restrictive measures will be taken and that the banks will provide the additional credit demanded when the harvest season begins next month without fear that stock speculation will divert the credit supply to itself.

But this is not to say that appreciably easier rates are to be expected, as the United States Treasury has been compelled to pay the high rate of 5¼ per cent on an issue of certificates made last week. As there is nothing to encourage the expectation of another boom the summer promises to be one of orderly liquidation. This will release a good deal of the capital latterly employed in carrying the securities bought for speculation, but seasonal agricultural and business demands will probably take up the slack.

The fluctuations of the "business cycle" in the United States in recent years have been so modified that the term is falling into disuse, but we are still far from the ultimate of stability, and present indications are that a downward trend is approaching.

MACHINE tool and machinery manufacturers and dealers are optimistic over prospects. A little falling off has been noted in some quarters, but no appreciable general summer slump is in sight. Prices hold firm. Deliveries are still back, but are improving. Demand is spread over a wide range of industries, with buying in small lots.

CHICAGO reports the year's business to date 50 per cent in excess of 1928, with, however, railroad buying slowing up, but used machines active. In Detroit the automobile plants are holding back on purchases, and accessory companies are even cutting production. Impending motor changes may account for the slump. The fall outlook is good. Indianapolis, however, reports good business from both these industries, and in die and toolroom equipment. Inquiries are good and manufacturers active in Cincinnati, with two large orders placed by automobile firms.

THE Southern district found May better than April, and June is favorable. Textile mill equipment and contractors' machinery are moving well. New York reports continued buying, but no large orders. Electrical instrument and airplane industries appear most active. In New England, aircraft engine manufacture is high, and three new airplane companies have been incorporated in Maine. Throughout Canada, building activity, mining and water power development, and the railroad demand, account for good business.

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The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

INDIANAPOLIS

Machinery and machine tool demand here seems to have reached the summer peak and the business apparently has settled down to a rather steady phase. Total business during May and the first week of June was slightly below the peak reached during April when most of the factories were preparing for the summer season. Sales are rather active, however, and the summer bids fair to excel in business that of last year.

Die and tool room equipment seem to be most active. This is particularly true of the smaller plants which now are producing some automobile parts or accessories. Judging from the directories, there appears to be a continued growth in the number of these small plants and they all apparently are doing business.

Weather conditions have held back building and in some respects this has injured machinery and tool sales. Several large expansions planned to be in operation during the early summer have been delayed and naturally the purchasing and delivery of equipment also has been held up.

Demand for tools from the automobile industry continues fair. The local factories are operating on better schedules than this time last year and the local assembly plant of the Ford Motor Car Co. is about in full production. The Marmon plant is working mostly on its new model, the Roosevelt. The early sales response is said to be good and production continues at April figures.

A considerable amount of special machinery is being used by the furniture and body factories and indications point to steady sales during the remainder of the summer. Contractors equipment is moving a little better than it did in May.

NEW ENGLAND

Market activity in the New England machine tool industry, while substantially below the brisk level experienced through the first quarter, is sufficient to keep dealers and builders optimistic. Inquiries have abated but little, and it is apparent that those in the long delivery class would be turned into immediate orders, if delivery could be made more promptly. The only logical conclusion seems to be that a shortening of three weeks time on existing order balances would produce a resumption of the record-breaking activity during the early months of the year. This, however, according to all indications, is still a matter of several months away.

Orders for milling equipment and large lathes placed during the week carried long deliveries. Orders for small tools were plentiful, and grinding machines were in heavy demand. The Billings & Spencer Co., Hartford, sold three motor-driven drop-forging hammers to the Spicer Manufacturing Co., Toledo; and one to the Moore Drop Forge Co., Springfield.

Aeronautical requirements and schedules are being stepped up from week to week. The Ford company increased delivery requirements on engines from the Pratt & Whitney Aircraft Co., Hartford, 50 per cent for June. Travelair has jumped 350 per cent on June requirements for airplane engines from the same concern. The Pratt & Whitney Aircraft Co. has booked an order for 25 Hornet airplane engines to go into new Navy bombing planes.

Expansion in this field bids fair to outdo all booms of the past in any line of industry within a remarkably short space of time. All parts of New England are feeling the influx of aeronautical activity. Maine incorporated three companies into this field during the current week, namely: the Crymble Aircraft Corporation, Bangor, Frank Crymble, Jr., president; the Maine Seaplane Terminals, Inc., Portland, Olcott S. Payson, president; and the Portland Air Terminals, Portland, Clifford Strange, president.

SOUTHERN DISTRICT

During the last week in May and the first week in June there was little change in the machine tool and machinery situation in the southern district. With the total volume of business booked during May reported to be slightly better than the April volume, the outlook was considered by most dealers to promise better business during June because of the steady improvement in industrial conditions in the southeastern territory during the past three or four weeks.

There is still an excellent demand for equipment from the textile mill field, mainly for new mill construction now under way in the Georgia, Alabama, Carolina and East Tennessee district. Active inquiry indicates that there will be no immediate let-up in demand from these buyers. Orders are somewhat better for contractors' equipment, especially in the larger cities of the Southeast, where a considerable amount of new building is in progress, and are also reported fairly active from road-building contractors in all of the southeastern states. Both these lines during May showed a gain over the same month of 1928, but in view of the fact that sales were generally slow earlier in the year, the total volume of such business to date is not up to the level of the corresponding period last season.

Railroads are reported still buying on a fair basis of heavier equipment, with inquiries good, and the outlook promising continued fair demand from buyers in this field through the summer months. There is, however, little demand reported from the lumber or woodworking industries, nor do inquiries indicate there will be any great amount of such buying during the next few weeks. Smaller machine shops and garages are placing a few orders for used or rebuilt machinery and tools, but are buying little in the way of new equipment.

CANADA

Outstanding features of the metal-working situation in Canada are the well-maintained activity in the iron and steel industry, the output at some plants registering new high records; extensive mining and water power developments which call for a very large amount of machinery and supplies; and the growing demand for all kinds of constructional material, resulting from the extensive new building program which is being undertaken in almost every section of the country.

Operations at the plants of the Canadian Car and Foundry Co. are being maintained at capacity, with occasional night shifts in some of the shops. All orders received have been turned out on scheduled time, and there are sufficient orders on hand to keep the plants busy until at least the end of the fiscal year, September 30. The company has just received a further order from the Canadian Pacific Railway for 500 flat cars at a cost of approximately $1,500,000.

The Canadian Locomotive Co., Ltd., has received an order for the construction of two 12-wheel locomotives for the Government of Jamaica. The Dominion Bridge Co. has been awarded a contract for the supply of structural steel that will enter into the erection of the new $5,000,000 hotel which the Canadian National Railway is erecting in Vancouver, B. C.

Hayes Wheels and Forgings, of Chatham, Ont., is about to broaden the line of its output. The addition to the plant at Chatham, which was undertaken at an estimated cost of $1,000,000, is expected to make a difference of $2,000,000 in the business of the company. Arrangements are being made for the manufacture of universal joints, the first of their kind as yet undertaken in Canada.

Production of automobiles during April at 41,901 cars set up a new high record for the second month in succession. The output was 3 per cent greater than production for March and 60 per cent above the average for the twelve months ending April, computed at 26,254 cars.

Agricultural implement makers are busy with demand steady at present, although there are indications that the decline in wheat prices will seriously affect the purchasing power of the farmers.

CHICAGO

A slight tapering off in the volume of machine tool business is reported for the last week. In the main, however, sales are holding up remarkably well, and the level maintained for the last four months was but little lowered. With some manufacturers' agents and distributors, the sales record for May was reported as better than that of April, but with most machinery houses no material change was noted either way. The belief is expressed among the trade that there will be a gradual recession toward the close of this month, but that the midsummer seasonal slump, usually beginning in July, will be far less than in preceding years. The total of business in machine tools this year up to the end of May is said to rate at least 50 per cent ahead of the same period in 1928.

Railroad buying is slowing up. The Union Pacific has bought against practically all the items on its list. Some good orders were received during the week from the Chicago, Milwaukee, St. Paul and Pacific.

Inquiries from the Board of Education for new equipment for technical high schools are reported, these consisting mainly of woodworking tools. Business in used tools continues on a good level. Deliveries show but little improvement.

CINCINNATI

Taking the machine tool industry of the Cincinnati district as a whole, business was at a very good level in the past week. With a few manufacturers there was a slight lull, but this was offset by gains made by others, and the aggregate bookings were practically the same as in the previous week.

Selling agents report a very good demand in the past week, in some cases better than in the previous one, the great majority of the orders calling for single tools and replacements. The market in local and

adjacent territory is showing a tendency to improve, it is stated, and a further increase in the demand is expected.

With the manufacturers good volume of well-scattered orders featured the week. Two good-sized orders from the automotive field were reported by one manufacturer, but with others the orders received from this market were largely confined to single items. Railroad purchases reported were confined to single items. The week's inquiries were large in number and of excellent tone, the great majority being for single tools and replacements.

Manufacturers report that production is at a good level, with sufficient business on hand and in sight to keep plants active for some time to come.

DETROIT

There has been a noticeable decrease in the number of inquiries and in the volume of orders received, and dealers in all lines report a general slowing up. Most of the dealers classify the present condition as about normal for this time of the year. Automobile manufacturers are buying little equipment, aside from that which is needed for replacement. The accessory manufacturers are cutting down production and are spending very little money for machinery or tools. The small shops are also a great deal less active than they were in April and May; many of them have cut their payrolls substantially and are planning further reductions.

Most of the leading machinery and machine-tool dealers believe the present condition will continue through June and July although several of them predict a healthy improvement in the market during the present month. A number of bid orders are in prospect, and if they materialize they will be sufficient to bring the general level of sales up to a point that will compare fairly well with the totals of other months this year.

At least two of the large automobile manufacturers are contemplating sweeping changes in motor construction. Whether these changes will be made this summer, or later in the year, or not at all, has not yet been revealed. However, it is known that these manufacturers, and several others, have engaged in considerable research, much of it in the direction of the rumored changes. A number of them are considering the development of eight-cylinder motors instead of sixes, but thus far no orders for machinery have been placed. The increasingly strong competition in the motor car industry is responsible for the many changes being made.

Should the heavy fall sales develop as expected, the record for the year will probably be a phenomenal one. Thus far the volume of sales in this area is far ahead of any year in the history of the machinery and machine-tool trade. General business conditions are fairly good.

NEW YORK

In the Metropolitan area the general situation in regard to machine sales continues good. Some dealers report an unabated flow of inquiries, followed by placing of orders, although bids are not acted on so promptly as a month ago. A few companies have experienced a falling off of about 10 to 15 per cent from the previous high average. But the general outlook for June is about equal to May thus far, and well up to the record maintained since the first of the year.

Although it is too early to predict the summer trend there is no strong indication of a cessation of buying, and the approaching season bids fair to come well up to July and August of last year. Demand seems strong, and the only unfavorable element is the vacation period, with its tendency for postponing executive approval of purchases. Buying is still extended over a wide range of industries, with the electrical instrument companies especially active. All types of machines and tools are being purchased, although there has been some falling off in demand for large, heavy equipment, and for certain small machines. Orders placed are usually for one or two machines, although at least one order awarded was for four machines. The only large inquiry reported is the Curtis-Caproni list, just issued. The Delaware, Lackawanna & Western Railroad has placed orders for about $70,000 worth of machines, closing its purchasing with only about 30 per cent of the equipment on its original inquiry list. Western Electric is still buying for the Baltimore plant and there is some General Electric and New York Central business being obtained.

An increase of 7½ per cent in the price of precision bench lathes has been announced by one company. Other prices are holding firm.

Deliveries in a few cases are improving, especially where there has been some falling off in orders placed. One dealer quotes from 5 to 8 weeks on standard machines. On boring mills and radial drills, however, deliveries are still back, and quotations for as late as November and December are being accepted.

The used machinery market was exceptionally good in May, and the June outlook is promising. Orders are for individual machines rather than quantities, although some run up toward $5,000 total. Automatics are scarce, but other types are not so hard to secure. Stocks are not large, and equipment bought and reconditioned moves fast.

Sales made during the last week by the Triplex Machine Tool Company include: One Fosdick radial drill, one Triplex machine, two Campbell nibbling machines, four sensitive floor drill presses, and one bench tapping machine.

Business Items

The Carborundum Co. of Niagara Falls, N. Y., announces several changes in its sales personnel: C. J. Steuber, who has been district sales manager with headquarters in Milwaukee, has been appointed district sales manager at Detroit, succeeding Anthony Dobson who is retiring. Mr. Steuber's headquarters will be in the new Carborundum Building, at 2759 East Grand Boulevard. H. E. Kerwin has been appointed district sales manager at Milwaukee, to succeed Mr. Steuber. Since 1910 Mr. Kerwin has been at the Chicago office. Robert Rainnie, formerly a member of the Carborundum sales engineering staff, will take over Mr. Kerwin's territory in the Chicago district. George Harden has been appointed sales manager for Germany, and he will make his headquarters at the Deutsche Carborundum Werke, at Dusseldorf. Mr. Harden previously covered the sales territory in and about Flint, Saginaw and Bay City, Mich., which will now be taken over by J. C. Gallen, who formerly covered the Lansing and Ann Arbor, Mich., district. H. S. Monroe has been appointed to take over Mr. Gallen's old territory. Previous to this change Mr. Monroe represented the Carborundum Co. as one of its grinding wheel salesmen in Detroit. His old territory will be taken over by Philip R. Dumas.

The Steubing Cowan Co., Cincinnati, Ohio, and Holyoke, Mass., is now erecting at Cincinnati a modern plant for the manufacture of lift trucks and platforms. On a 4-acre tract will be erected the first unit, consisting of a one-story fireproof structure, 160x330 ft., with a two-story office building, at an approximate cost of $200,000. The location will provide for two and one-half times the present production, and modern production equipment will be installed. All process material in the plant will be handled by the lift truck system. The company recently expanded its Holyoke plant, and it maintains two plants in Canada, one in Granby, Quebec, and the other at Toronto, as well as a plant at Moosburg, Bavaria.

Consolidation of the Rockford Union Foundry Co. and the Sundstrand Machine Tool Co., Rockford, Ill., as the Sundstrand Machine Tool Co., with Hugo L. Olson, president and general manager, was announced this week. Levin Faust and G. D. Sundstrand become vice-presidents; George A. Lindblade, secretary-treasurer and G. H. Ekstrom, assistant secretary-treasurer. Charles Rystrom, retiring president of the Sundstrand company, will become chairman of the board. Offering of 66,250 shares of the 86,250 shares of the company through the Chicago stock exchange does not represent new financing, officers stated, resulting from acquisition of holdings of an estate. Both companies will continue to operate as heretofore.

The Parker Rust-Proof Co., 2177 East Milwaukee Ave., Detroit, and the Wolverine Enameling Co., also of Detroit, have been merged, the name of the Parker Rust-Proof Co. being retained. The consolidated company has assets of $1,500,000. The Parker company has developed a new process called "Bondering," a primer base for paint, enamel or lacquer when applied to steel, and the plant and business of the Wolverine company was acquired for the laboratory and experimental work in connection with the application of this process.

Announcement of the addition of a new body plant to the Studebaker factory at Walkerville, Ont., was made recently by D. R. Grossman, vice-president and general manager of the Studebaker Corporation of Canada, Limited. The new unit will be devoted exclusively to the manufacture of bodies for Studebaker and Erskine passenger cars, including all operations necessary for constructing, upholstering, trimming and painting. All sections of the plant are now in operation.

The Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., is starting an expansion program involving the expenditure of $150,000 for buildings and $75,000 for equipment, according to H. W. Sweatt, vice-president and general manager. The present plant is operating at full capacity, working 24 hours a day at the Minneapolis plant. The three plants at Wabash, Ind., are also operating at full capacity. The company now employs about 1,700 persons, 800 of which are in Minneapolis.

The Hayes-Custer Stove and Furnace Co., Bloomington, Ill., which was swept by a $200,000 fire on May 25, will

be rebuilt shortly, according to George Custer, vice-president. The blaze swept through nearly two-thirds of the plant, but the new foundry and enameling room were saved, although 1,000 stoves in process of assembly were ruined. The company has expanded rapidly in the last few years, and had anticipated production of nearly 20,000 units this year.

The British Columbia Electric Railway Co. has started the construction of a new machine shop and workroom for its maintenance department at Vancouver, B. C. The machine shop, winding room, and finishing room will occupy the main portion of the building, which is 40 ft. high and occupies an area of 121x57 ft. The total expenditure is estimated at $40,000.

The Automotive Gear Works, Richmond, Ind., is to construct an addition to its plant to cost approximately $20,000. The new addition will be two stories high and will measure 40 x 150 ft. The addition will be used exclusively for offices and storage purposes, making it possible to devote all the remainder of the factory to production.

The Hughes Tool Co., Houston, Tex., manufacturer and distributor of machinery, tools, etc., in the southwestern district, has started the construction of a machine shop at Houston which will be ready to start operations this summer. An investment exceeding $100,000 is being made, not including cost of machinery and equipment.

The Fafnir Bearing Co., New Britain, Conn., has established a separate sales division to co-operate with aviation companies in the development of suitable ball bearings for use in airplane construction. The engineering staff of the Fafnir company is prepared to consult with aircraft builders in the development of aviation bearings.

The Warner Gear Co., Muncie, Ind., has announced an expansion program that will include the construction of a new factory unit and provide employment for about 500 additional employees. The new factory unit will provide about 80,000 sq.ft. of floor space.

The R. L. Carter Co., manufacturer of woodworking machinery, Phoenix, N. Y., represented in Chicago by G. A. Straus, has moved its Chicago office from 549 to 543 W. Washington St., where it has leased a room with display window on the ground floor.

The Knoxville (Tenn.) branch of the Chicago Pneumatic Tool Co., now located at 317 W. Cumberland Ave., will move shortly into new and larger quarters on Cumberland Ave., near Gay St. W. M. Clark is district manager.

The Leonard Spark Plug Co., incorporated recently at St. Petersburg, Fla., has leased buildings there and is establishing a plant for the manufacture of spark plugs, initial capacity to be 1,000 spark plugs per day.

The R. G. Smith Tool Manufacturing Co., manufacturer of special tools and machinery, located on New Jersey Railway Ave., Newark, N. J., has purchased the one-story brick factory building at 245 South Street, containing 15,000 sq.ft., from the Sterling Wax Paper Company.

Officials of the Wallace Foundry and Steel Co. of Lafayette, Ind., have filed papers with the secretary of state in Indianapolis, changing the name to that of the Wallace Steel and Supply Company.

Ewertz & Dalcher, consulting engineers on problems relating to welding, marine and mechanical engineering, have removed their office to 26 Cortlandt Street, New York.

Personals

EDWARD L. RYERSON, JR., has been elected president of Joseph T. Ryerson & Son, Inc., Chicago, Ill., succeeding Joseph T. Ryerson, who continues to hold the office of treasurer and member of the board. Mr. Ryerson, Jr., was graduated from Sheffield Scientific School (Yale) in 1908, and later attended the Massachusetts Institute of

Technology. He came to the Ryerson company in 1909, beginning in the plant operating department, and held the position of works manager for several years prior to the War. He entered the service early in the War with the Aircraft Production Board at Washington, and was later captain in the Air Service Division of the Signal Corps. He was elected vice-president of the Ryerson firm in 1922, and vice-president and general manager last year.

W. M. MCALLISTER, Sycamore, Ill., who heads a group of local people, has assumed control of the Turner Brass Works, Sycamore, one of the oldest and largest industries in the community. J. WALTER BECKER has been made vice-president and general manager of the company. HERBERT F. PAGEL, who succeeded William Pagel two years ago as head of the company upon Mr. Pagel's death, has disposed of most of his stock to the Sycamore syndicate. Mr. Becker was formerly associated with the Ideal Commutator Co., of Sycamore. Blow torches are chief product of the Turner Brass Works.

C. A. ANDERSON has been appointed sales manager of the Ford Chain Block Co., with headquarters at the general offices and works at Second and Diamond Streets, Philadelphia, Pa. The company manufactures "Tri-Bloc" chain hoists, worm gear hoists, differential hoists and I-beam trolleys, and maintains branches in Chicago, New York, New Orleans and Pittsburgh.

LOUIS PEIK, chief engineer of the American Foundry Equipment Co., Mishawaka, Ind., with Vern Minich, president of the company in New York, will shortly sail for Europe where they will visit leading cities.

Obituaries

D. T. HOMAN, vice-president of the Bridgeport Safety Emery Wheel Co., Bridgeport, Conn., recently died. He was born on June 3, 1846, near Yaphank, Long Island, was graduated from the Eastman College at Poughkeepsie, and entered the selling field shortly thereafter. In 1881 he associated himself with E. R. Hyde in the Springfield Glue and Emery Co. of Springfield, Mass., which later removed to Bridgeport, Conn. When the Bridgeport Safety Emery Wheel Co., Inc., was formed, Mr. Homan continued with Mr. Hyde, who is president, and was in charge of sales activities.

HERBERT J. MARSHALL, chairman and managing director of Marshall Sons & Co., Ltd., Gainsborough, England, manufacturers of steam engines and boilers, died recently at the age of 62.

WILLIAM ROSE, 72, founder of Rose Bros., Gainsborough, England, manufacturers of wrapping, packeting, and similar machinery, died recently.

ELLIOTT KEBLER, 69 years old, former president of the Fawcus Machine Co., Pittsburgh, died on May 31.

Forthcoming Meetings

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, June 24-28, at the Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

SOCIETY OF AUTOMOTIVE ENGINEERS. Summer meeting, Saranac Inn, Upper Saranac Lake, N. Y., June 25-28. Coker F. Clarkson, manager, 29 E. 39th St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Semi-annual meeting, Salt Lake City, Utah, July 1-4. Third national meeting of the Iron and Steel Division, during the Steel Treaters' Exposition, Cleveland, September 11-13. Calvin W. Rice, secretary, 29 West 39th St., New York City.

The Weekly Price Guide

Rise and Fall of the Market

BUYING for third quarter requirements has not yet made its appearance in the steel market. Orders for rolled products already booked, are in sufficiently large volume to insure maintenance of present activity in demand. Prices remain steady. The non-ferrous metals market has quieted down considerably. Solder is off 0.5c. per lb. (32c.) at New York warehouses, compared with prices of a week ago. Slab zinc, on the other hand, rose 0.2c. per lb. (6.8c.) at East St. Louis. Raw linseed oil sells at 11.2c. per lb. (1 to 4-bbl. lots) f.o.b. New York as against 11.1c., last week. The new differentials on blue-annealed sheets at Chicago are given in the accompanying table: eastern cities were unaffected by the change.

(All prices as of June 7, 1929)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$18.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 1.75@2.25)	21.25
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	15.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.76)	21.76
Virginia No. 2	24.79
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	21.26
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	20.26
Basic	20.26
Bessemer	20.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.20	3.35	3.25	3.90*
No. 12	2.15@2.25	3.45	3.30	3.95*
No. 14	2.25@2.35	3.55	3.35	4.00*
No. 16	2.35@2.45	3.65	3.45	4.10*
Black				
Nos. 18 to 20	2.65@2.75	3.85	3.70	3.80
No. 22	2.80@2.90	4.00	3.85	3.95
No. 24	2.85@2.95	4.05	3.90	4.00
No. 26	2.95@3.05	4.15	4.00	4.10
No. 28	3.10@3.20	4.75	4.15	4.25
Galvanized				
No. 10	2.80@2.90	4.20	4.05	4.05
Nos. 12 to 14	2.90@3.00	4.30	4.15	4.15
No. 16	3.00@3.10	4.40	4.25	4.25
No. 18	3.15@3.25	4.55	4.40	4.40
No. 20	3.30@3.40	4.70	4.60	4.55
No. 22	3.35@3.45	4.75	4.65	4.60
No. 24	3.60@3.70	4.90	4.75	4.75
No. 26	3.75@3.85	5.15	5.00	5.00
No. 28	4.00@4.10	5.40	5.25	5.25

*Up to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Glav.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
⅛	$0.17	1.315	1.049	.133
¼	.23	1.66	1.38	.14
⅜	.27½	1.9	1.61	.145
½	.37	2.375	2.067	.154
¾	.58½	2.875	2.469	.203
1	.76½	3.5	3.068	.216
1¼	.92	4.0	3.548	.226
1½	1.09	4.5	4.026	.237
2	1.27	5.0	4.506	.247
2½	1.48	5.563	5.047	.258
3	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

Thickness—Decimal Fractions	B.w.g. and	Outside Diameter in Inches—⅛	¼	⅜	½	⅝	¾	⅞	1	1¼	1½
		Price per Foot									
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23			
.049"	18	.17	.18	.19	.20	.21	.23	.25			
.065"	16	.19	.20	.21	.22	.23	.25	.27			
.083"	14	.20	.22	.23	.24	.25	.27	.29			
.095"	13	.21	.23	.25	.26	.27	.29	.31			
.109"	12	.22	.24	.26	.27	.28	.30	.32			
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33			
.134"	10	.24	.26	.28	.29	.30	.32	.34			

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.50	3.65	3.60
Cold drawn, flat or square‡	4.00	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	3.75†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$-in. thick. †Up to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse— $\frac{3}{32}$, 8.35c. per lb.; $\frac{1}{8}$, 7.85c. per lb.; $\frac{5}{32}$ to $\frac{1}{4}$, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			19.25
Tin, Straits, pigs, New York			47.00
Lead, pigs, E. St. Louis	6.80	New York	8.25
Zinc, slabs, E. St. Louis	6.80	New York	8.25

	New York	Cleveland	Chicago
Antimony, slabs	11.50	13.00	14.25
Copper sheets, base	27.75	27.75	27.75
Copper wire, mill, base	19.87½	19.87½	19.87½
Copper, drawn, round, base	26.25	26.25	26.25
Copper tubing, base	29.25	29.25	29.25
Brass sheets, high, base	23.25	23.25	23.25
Brass tubing, high, base	28.25	28.25	28.25
Brass rods, high, base	21.25	21.25	21.25
Brass wire, high, base	23.75	23.75	23.75

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25.00*	24.30	24.30
Zinc sheets (casks).....	10.50@11.00	11.70	10.11
Solder (½ and ½).....	32.00	32.75	31@34
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade.....			61.00
Commercial genuine, intermediate grade.....			45.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt.....			12.00

*Delivered.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished.....	52.00	42.00
Sheets, cold rolled.....	60.00	50.00
Strip, cold rolled.....	55.00	45.00
Rods, hot rolled.....	45.00	35.00
Rods, cold rolled.....	53.00	40.00†
Tubing.....	75.00*	90.00
Angles, hot rolled.....	50.00	40.00
Plates.....	52.00	42.00

*Seamless. †Cold drawn.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity offered for sale:

	New York	Cleveland	Chicago
Crucible copper.....	13.50 @13.75	13.50	13.00 @14.00
Copper, heavy, and wire..	13.50 @13.75	13.00	12.00 @13.00
Copper, light, and bottoms	12.00 @12.25	12.50	11.00 @12.00
Heavy lead.....	5.12½@ 5.62½	6.25	5.00 @ 5.50
Tea lead.....	2.37½@ 2.87½	4.25	4.00 @ 4.50
Brass, heavy, yellow.....	9.00 @ 9.25	8.00	8.00 @ 8.50
Brass, heavy, red.....	.....	12.50	12.00 @12.50
Brass, light.....	7.37½@ 7.50	7.50	8.00 @ 8.50
No. 1 yellow rod turnings.	9.25 @ 9.50	9.00	10.00 @10.50
Zinc.....	3.75 @ 4.00	3.25	3.00 @ 3.25

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20.....	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20.....	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20.....	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.†	.16	38.00 per M	.16
Sal soda, per lb.....	.02½	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.112	.11	.114
Cutting oil, about 25% lard, in 5 gal. cans, per gal.....	.55	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal..	.33	.36	.35
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt...	30– 5%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60– 5%	50–10%

*All waste in bale lots. †100-lb. bales.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb..	$0.0325	$0.0325	$0.0325
Cold drawn shafting...	per lb..	.035	.035	.034
Brass rods.....	per lb..	.2125	.2125	.17
Solder (½ and ½).....	per lb..	.32	.3225	.3275
Cotton waste, white...	per lb..	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.....	per 100.	3.60	3.60	3.10
Lard cutting oil.....	per gal.	.55	.55	.65
Machine oil.....	per gal.	.33	.33	.30
Belting, leather, medium.....	off list..	30–10%	30–10%	31½%
Machine bolts, up to 1x30 in., full kegs...	off list..	50-10%*	50–10%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper.....	$4.50	$4.29	$4.29
Emery cloth.....	22.93	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper.....	2.64	2.04	2.04
Cloth.....	3.60	3.59	3.59
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville,		2.75@2.85
Coke, prompt foundry, per net ton...	Connellsville,		3.75@4.50
White lead, dry or in oil...	100 lb. kegs....	New York,	13.75
Red lead, dry.....	100 lb. kegs....	New York,	13.75
Red lead, in oil.....	100 lb. kegs....	New York,	15.25

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less.....	60%
Larger, up to 1 x 30-in., full kegs, list less.....	50–10%
Less than full kegs or case lots, add to list.....	10%
Fitting-up bolts: list less.....	45%
Lag screws:	
Up to ½-in. x 6-in., list less.....	60%
Larger, list less.....	50–10%
Less than full keg or case lots, add to list.....	10%
Rivets:	
Structural, round head, full kegs, net.....	$4.50
Structural, round head, broken kegs, net.....	6.00
Tank, 7/16-in. dia. and smaller, list less.....	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less.....	60%
Larger, up to 3-in., list less.....	40–10%
Less than keg or case lots, add to list.....	10%
Washers:	
Wrought, full kegs, per 100 lb., list less.....	$4.00
Wrought, broken kegs, per 100 lb., list less.....	2.00
Turnbuckles:	
With stub ends, list less.....	20%
Without stub ends, list less.....	50%
Chain:	
Proof coil, base, per 100 lb., net.....	$7.10
Cast iron welding flux, per lb., net.....	.40
Brazing flux, per lb., net.....	.80

Machine Requirements and Industrial Construction

Equipment Wanted

Mich., Detroit—Clayton Lambert Co., French Rd. — miscellaneous machine shop equipment for proposed 1 story, 100 x 100 ft. torch and burner factory. Estimated cost $40,000.

Mich., Detroit — Peoples Outfitting Co., 150 Michigan Ave.—machinery and equipment for finishing furniture for proposed 4 story, 321 x 600 ft. factory on West Warren St.

O., Cleveland—Hendey Machine School, 2120 Prospect Ave.—lathe, 16 x 16 or 8 ft.

O., Cleveland—Globe Steel Barrel Co., 8205 Franklin Ave., D. W. Sanders—machinery and equipment for the manufacture of steel barrels.

O., Oak Hill—Milton Motor Co., J. A. Milton, Mgr.—milling machine, air compressor, etc. for proposed new service station.

Ont., Freeman — Glover Basket Co.—machinery and equipment for basket factory to replace fire loss. $50,000.

Ont., Owen Sound—Empire Stove & Furnace Co., Third Ave. E.—machinery and equipment for proposed 50 x 90 ft. enameling plant. Estimated cost $25,000.

Que., Montreal—Modern Table Co., Ltd., 502 Ste. Catherine St. E.—woodworking equipment for proposed factory on Drolet St. Estimated cost $50,000.

Opportunities for Future Business

Calif., Culver City — Metro-Goldwyn-Mayer Film Corp., Culver City, awarded contract for converting present plant into sound proof studio to include planing mill, machine, carpenter and paint shops, etc. Estimated cost $1,000,000.

Calif., Sacramento—F. P. Doe Lumber Co., Russ Bldg., San Francisco, had plans prepared for the construction of a mill for the manufacture of white pine mouldings, etc. at Third and Y Sts. Estimated cost $25,000. Private plans.

Calif., San Diego — San Diego High School Dist., is having plans prepared for the construction of a 1 story high school including shop, etc. Estimated cost $400,000. Kistner & Co., Architects Bldg., Los Angeles, Archts.

Calif., San Francisco — C. H. Strub, 374 Valencia St., is having preliminary plans prepared for a 10 story garage at Sutter and Stockton Sts. Estimated cost $250,000. G. A. Applegarth, Claus Spreckels Bldg., Archt.

Calif., San Jose—Barshow & Baleria, 501 South Market St., is receiving bids for a 1 story automobile body building plant on Almaden Ave. Estimated cost $11,000.

Colo., Pueblo—Bd. of Education, School Dist. 20, O. Hellbeck, Central High School Bldg., Secy., will soon award contract for the construction of a 2 story addition to junior high school including two large shops, etc. at Broadway and Orman Ave.

Ga., Atlanta — Mueller Co., Decatur, Ill., manufacturers of cast iron pipe and brass products, plans the construction of first unit of plant here. Estimated cost $100,000.

Ill., Chicago—55th Ritz Garage Co., 55th St. and Lake Park Ave., awarded contract for the construction of a 3 story garage.

Ill., Chicago—J. L. Kesner, 5 North Wabash Ave., awarded contract for the construction of a 27 story, 54 x 144 ft. garage at 18-30 West Quincy St. Estimated cost $2,500,000.

Ill., Chicago—H. Kramer & Co., 2125 Loomis St., awarded contract for the construction of a smelting plant. Estimated cost $100,000. Noted Apr. 25.

Ill., Chicago—Ruth & Page, Inc., 38 South Dearborn St., awarded contract for a 29 story, 70 x 93 ft. garage at 329-35 Plymouth Court. Estimated cost $1,000,000.

Ill., Chicago — Vandercook Sons, 900 North Kilpatrick St., awarded contract for a 1 story, 62 x 124 ft. factory for the manufacture of printers' machinery at 4720-24 Iowa St. Estimated cost $20,000.

Ind., Indianapolis—Ford Motor Co., 1315 East Washington St., awarded contract for a 4 story, 38 x 314 ft. factory. Estimated cost $250,000.

Ind., Kokomo—J. Dietzen, awarded contract for a 2 story, 40 x 150 ft. machine shop and garage on North Washington St. Estimated cost $47,000.

La., New Orleans—American Can Co., 120 Broadway, New York, N. Y., will build a 5 story, 96 x 220 ft. addition to plant here, also plans addition to plant at San Francisco, Calif. $500,000.

Md., Baltimore—Guilford Realty Co., plans the construction of a 5 story garage.

Mass., Brookline (br. Boston)—A. Snyder and M. Rudnick, 18 Tremont St., Boston, is having plans prepared for a 2 story, 100 x 135 ft. garage and repair shop, etc. at 754 Commonwealth Ave. and St. Marys St. Estimated cost $250,000. H. F. Bryant & Son, 334 Washington St., Brookline, Archts.

Mass., Chelsea—The Texas Co., 31 St. James Ave., Boston, will soon award contract for a 2 story, 40 x 145 ft. garage, repair shop, warehouse, etc. Estimated cost $75,000. Private plans.

Mass., Fitchburg—Fitchburg Gas & Electric Co., 655 Main St., will soon award contract for a 1 story, garage and repair shop. Estimated cost $40,000 to $50,000. C. H. Tenney Co., 200 Devonshire St., Boston, Archt.

Mass., Pittsfield—Nesbit Garage Co., 705 North St., awarded contract for a 1 story, 72 x 300 ft. garage at Wahconah and North Sts. Estimated cost $75,000.

Mass., Swampscott (Br. Lynn)—Hume Pipe Co. of New England, J. H. Cooke, Treas., Danvers St., will build a 1 story, 70 x 145 ft. factory. Estimated cost $40,000. Private plans.

Mich., Dearborn—Stout Airplane Division, Ford Motor Co., is having plans prepared for a 1 story, 190 x 600 ft. factory on Oakwood Blvd. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

Minn., Minneapolis — Minneapolis-Honeywell Regulator Co., H. W. Sweatt, V. Pres. and Gen. Mgr., 4th Ave. S. between 27th to 28th Sts., awarded contract for a 6 story addition to factory. Estimated cost $200,000.

Mo., Independence — Independence Stove & Furnace Co., 700 South Cottage St., awarded contract for a 1 story, 65 x 120 ft. addition to stove plant. Estimated cost $50,000.

N. J., Jersey City—J. Goldenberg, 80 Woodland St., Englewood, will receive bids about July 1, for a 3 story, 150 x 230 ft. garage at Sip and Summit Aves. Estimated cost $500,000. C. Shilowitz, 26 Journal Sq., Jersey City, Archt. Noted May 9.

N. J., Newark—American Platinum Works, 231 New Jersey Railroad Ave., will receive bids about June 14 for a 4 and 5 story addition to factory on River St. and New Jersey Railroad Ave. Estimated cost $50,000. F. A. Phelps, 21 Fulton St., Archt. Noted May 30.

N. J., Paterson—Wright Aeronautical Corp., 238 Lewis St. is having plans prepared for a 1 story addition to factory on Madison Ave. Estimated cost $750,000. Private plans. Noted May 30.

N. Y., Brooklyn—Economy Auto Supply Co., H. Koepel Pres., 1691 Bedford Ave., plans a 1 story, 100 x 100 ft. garage at Quentin Rd. and East 9th St. Estimated cost $40,000. C. Goodman, 375 Fulton St., Archt.

N. Y., Brooklyn—Grand Atlantic Corp., H. S. Hendrickson, Pres., 253 Broadway, New York, plans a 100 x 155 ft. garage, etc. at Atlantic and Grand Aves. Estimated cost $250,000. H. Chapman, 315 5th Ave., New York, Archt.

N. Y., Brooklyn—J. McGrath, 87 Monitor St., plans the construction of a garage at Leonard St. and Engert Ave. Estimated cost $40,000. J. J. Architecture Service, 16 Court St., Archt.

N. Y., Brooklyn—F. Serdenberg, 564 Montgomery St., will soon receive bids for the construction of a garage at Lorimer St. and Marcy Ave. Estimated cost $60,000. H. J. Nurick, 44 Court St., Archt.

N. Y., Brooklyn—J. Siegel Mason Co., 285 Buffalo Ave., plans a 100 x 110 ft. garage, etc. at 62nd St. and 16th Ave. Estimated cost $40,000. E. M. Adelsohn, 26 Court St., Archt.

N. Y., Brooklyn—H. M. Sushan, 367 Fulton St., plans a 1 story, 204 x 250 ft. garage at East 98th and Union Sts. Estimated cost $40,000. J. S. Construction Co., 133 Floyd St., Archt.

N. Y., New York — Central Union Gas Co., 130 East 15th St., plans a 120 x 160 ft. garage and service station. Estimated cost $40,000. J. F. Hunter, New Rochelle, Archt.

N. Y., New York—M. N. Natanson, 522 5th Ave., plans the construction of a 6 story, 197 x 200 ft. garage at 10th Ave. and 38th St. Metropolitan Distributors Inc., c/o owner, lessee.

N. Y., New York—Zupan Printers, Inc., 850 9th Ave., will receive bids in August for the construction of a garage and shop at 729 West 186th St. Estimated cost $75,000. J. C. Hankinson, 529 West 111th St., archt. Noted Mar. 21.

N. Y., Poughkeepsie—De Laval Separator Co., Pine St., awarded contract for the construction of a foundry. Noted May 16.

N. Y., St. George (Sta. Staten Island)—Merritt Chapman & Scott, 17 Battery Pl., New York, will build machine and carpenter shops here. Estimated total cost, $75,000. Noted May 16.

O., Canton—Dept. of Highways, R. W. Waid Dir., Ohio-Hartman Bldg., Columbus, will soon award contract for a 1 story, 40 x 125 ft. garage. H. B. Briggs, Ohio-Hartman Bldg., Columbus, Archt.

O., Cleveland — Bender Body Co., H. Bender, Pres., 6409 Barberton Ave., had plans prepared for a 1 story, 135 x 175 ft. factory for the manufacture of automobile bodies. Estimated cost $150,000.

O., Cleveland—Lakeland Aviation Co. Inc., J. E. Mathews, Pres., 1070 Union Trust Bldg., had plans prepared for the construction of a factory at East 30th and Lakeside Ave. Private plans.

O., Cleveland—J. Laub Baking Co., West 50th St. and Lorain Ave., awarded contract for a 1 story, 40 x 122 ft. auto repair shop at 2024 West 48th St. Estimated cost $40,000.

O., Elyria—Cleveland Automatic Machine Co., is having plans prepared for the construction of a factory. Estimated cost $250,000. Wright & Nice, 4339 South Saginaw St., Flint, Mich., Archts.

O., Elyria — Elyria Belting & Machine Co., A. Altfeld, Pres. and Treas., Lorain, is having plans prepared for a 1 story, 40 x 105 and 60 x 80 ft. factory here. Estimated cost $40,000. C. Waite, Masonic Temple Bldg., Elyria, Archt.

Pa., Hollowell—Pitcairn Aircraft Co., Bryn Athyn, awarded contract for a 1 story, 37 x 150 ft. factory here. Estimated cost $100,000.

Pa., Homestead — Standard Propeller Co. awarded contract for a 3 story, 130 x 240 ft. plant. Estimated cost $250,000.

Pa., Philadelphia—Federal Container Co., Paschall and 56th Sts., awarded contract for a 2 story, 47 x 324 ft. plant. Estimated cost $190,000.

Pa., Philadelphia—West Philadelphia Motor Co., 4227 Chestnut St., plans a 2 story, 65 x 215 ft. garage. Estimated cost $160,000. P. S. Tyre, 114 South 15th St., Archt.

Pa., Pittsburgh—Fourth Ave. Garage Co., 4th Ave., awarded contract for a 3 story, 100 x 100 ft. addition to garage at 4th Ave. Estimated cost $150,000.

Pa., Wilmerding—Western Electric & Mfg. Co., East Pittsburgh, awarded contract for a 1 story, 63 x 176 ft. high testing building here. Estimated cost $100,000.

Wash., Seattle — Boeing Airplane Co., 330 West Front St., awarded contract for the construction of a 100 x 200 ft. hangar, etc. at Boeing field. Estimated cost $75,000.

Man., Winnipeg—Hilton Corrugated Box Co., Lombard St., will receive bids in June for extension to plant. $50,000.

Man., Winnipeg — Manitoba Bridge Works, Logan Ave. W., will receive bids in June for addition to plant. $100,000.

Man., Winnipeg—Vulcan Iron Works, Point Douglas St., will receive bids in June for extensions and improvements to plant. Estimated cost $225,000.

Man., Winnipeg—Western Steel Products Co., Desautels St., will receive bids in June for addition to plant. $200,000.

Ont., Burnaby — Dominion Bridge Co., Dominion Station Lachine, Montreal, Que., had plans prepared for the construction of a new plant here.

Que., Montreal—Zetland Garage Ltd., plans the construction of a garage on Craig St. W. Estimated cost $300,000.

Sask., Regina—W. D. Beath & Sons, 394 Symington St., Toronto, Ont., plans the construction of a plant for the manufacture of steel containers and tank, dump and grain truck bodies for automobiles. Estimated cost $200,000.